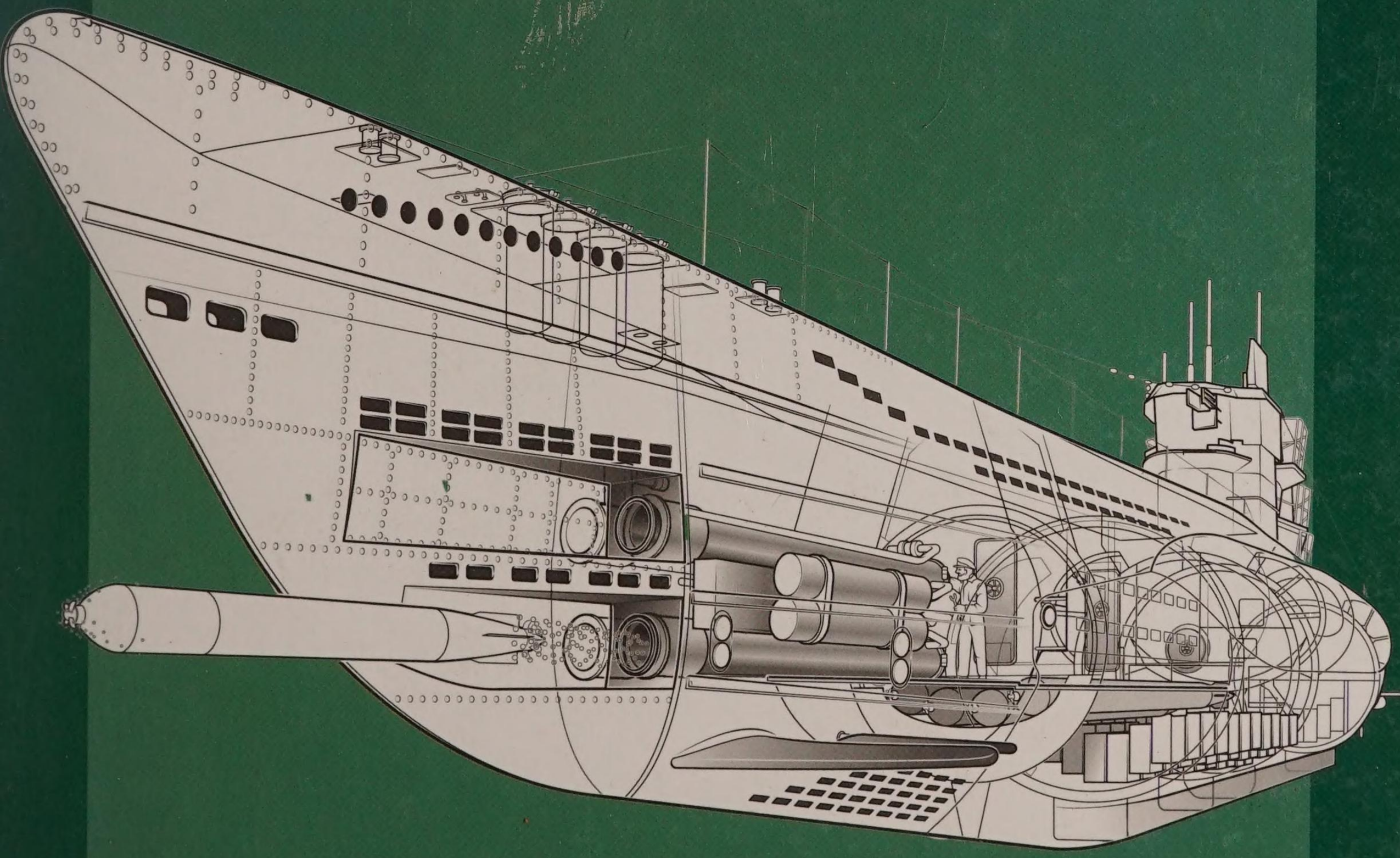
U-BOAT

1936–45 (Type VIIA, B, C and Type VIIC/41)

Owners' Workshop Manual



An insight into the design, construction and operation of the most feared German U-boat of World War 2

22 DEC 2016
07 SEP 2017
13 APR 2018

This book should be returned/renewed by the latest date shown above. Overdue items incur charges which prevent self-service renewals. Please contact the library.

Wandsworth Libraries
24 hour Renewal Hotline
01159 293388
www.wandsworth.gov.uk

THE BRIGHTER BOROUGH
Wandsworth

9030 00004 0829 0

COVER CUTAWAY: **Type VII U-boat.** *(Roy Scorer)*

Dedication

This book is dedicated to submariners of all nations – yesterday, today and tomorrow.

© Alan Gallop 2014

All rights reserved. No part of this publication may be reproduced or stored in a retrieval system or transmitted, in any form or by any means, electronic, mechanical, photocopying, recording or otherwise, without prior permission in writing from Haynes Publishing.

First published in October 2014

A catalogue record for this book is available from the British Library.

ISBN 978 0 85733 404 6

Published by Haynes Publishing,
Sparkford, Yeovil,
Somerset BA22 7JJ, UK.
Tel: 01963 442030 Fax: 01963 440001
Int. tel: +44 1963 442030
Int. fax: +44 1963 440001
E-mail: sales@haynes.co.uk
Website: www.haynes.co.uk

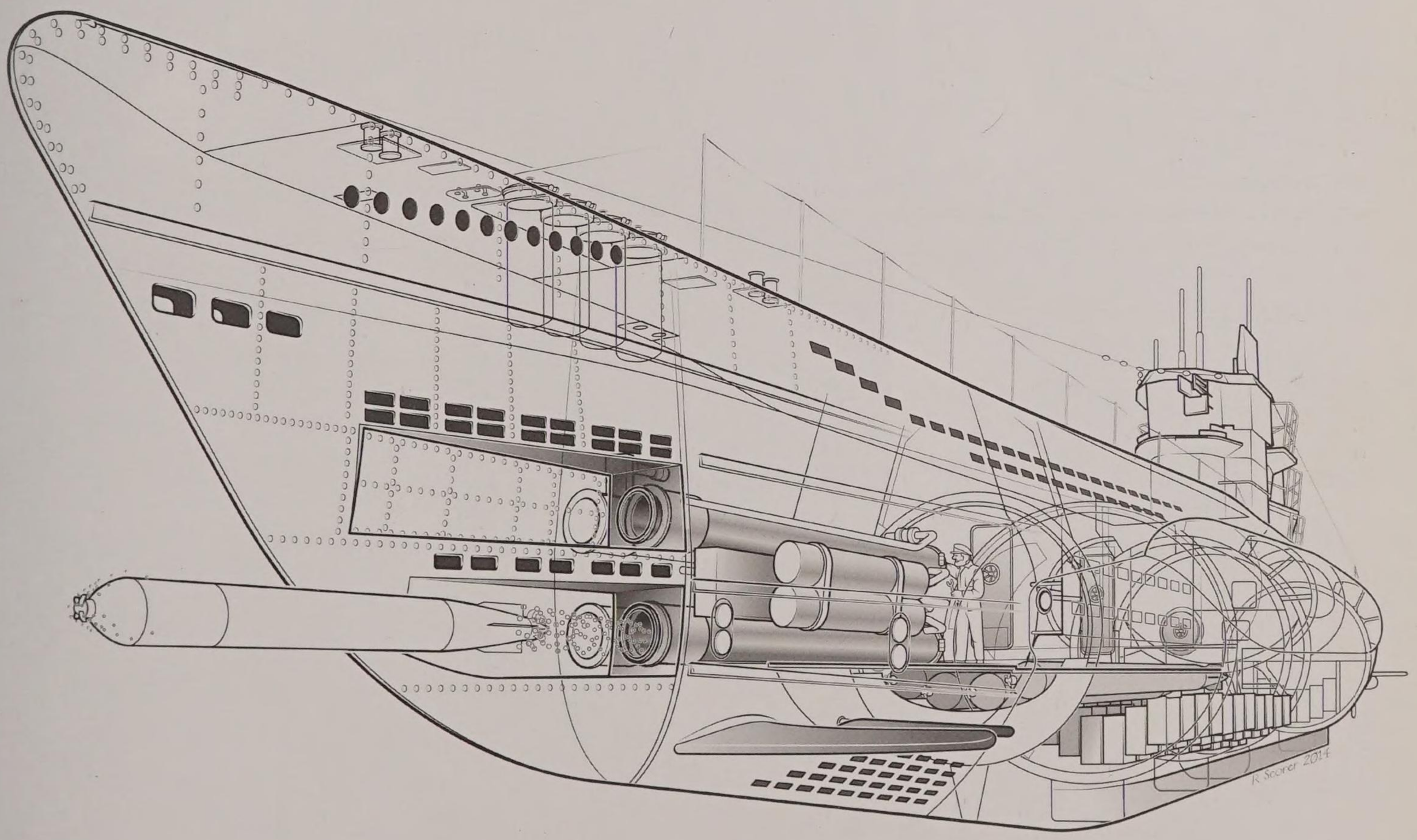
Haynes North America Inc.,
861 Lawrence Drive, Newbury Park,
California 91320, USA.

Printed in the USA by Odcombe Press LP,
1299 Bridgestone Parkway, La Vergne, TN
37086.

U-BOAT

1936–45 (Type VIIA, B, C and Type VIIC/41)

Owners' Workshop Manual



An insight into the design, construction and operation of the most feared German U-boat of the Second World War

Alan Gallop

LONDON BOROUGH OF WANDSWORTH	
9030 00004 0829 0	
Askews & Holts	06-Nov-2014
623.825709	£21.99
	WWX0012901/0233

Contents

06 Acknowledgements

08 Introduction

12 The U-boat story

'Onkel Karl' – Grand Admiral Karl Dönitz 18
Das Schnorchel (the Snorkel) 24

40 The U-boat at war

U-47 and 'The Bull of Scapa Flow' 46
Atlantic coast U-boat bases 52
Skilled and forced labour, U-boat factories and bases 54
Operation Deadlight 66

68 Anatomy of the Type VII class

Type VII class U-boats – technical specifications 70
Type VII class variations 72
Type VII class U-boats – external and internal sections 79

108 Type VII armament

Eels, torpedoes and mines 117

122 Type VII crew

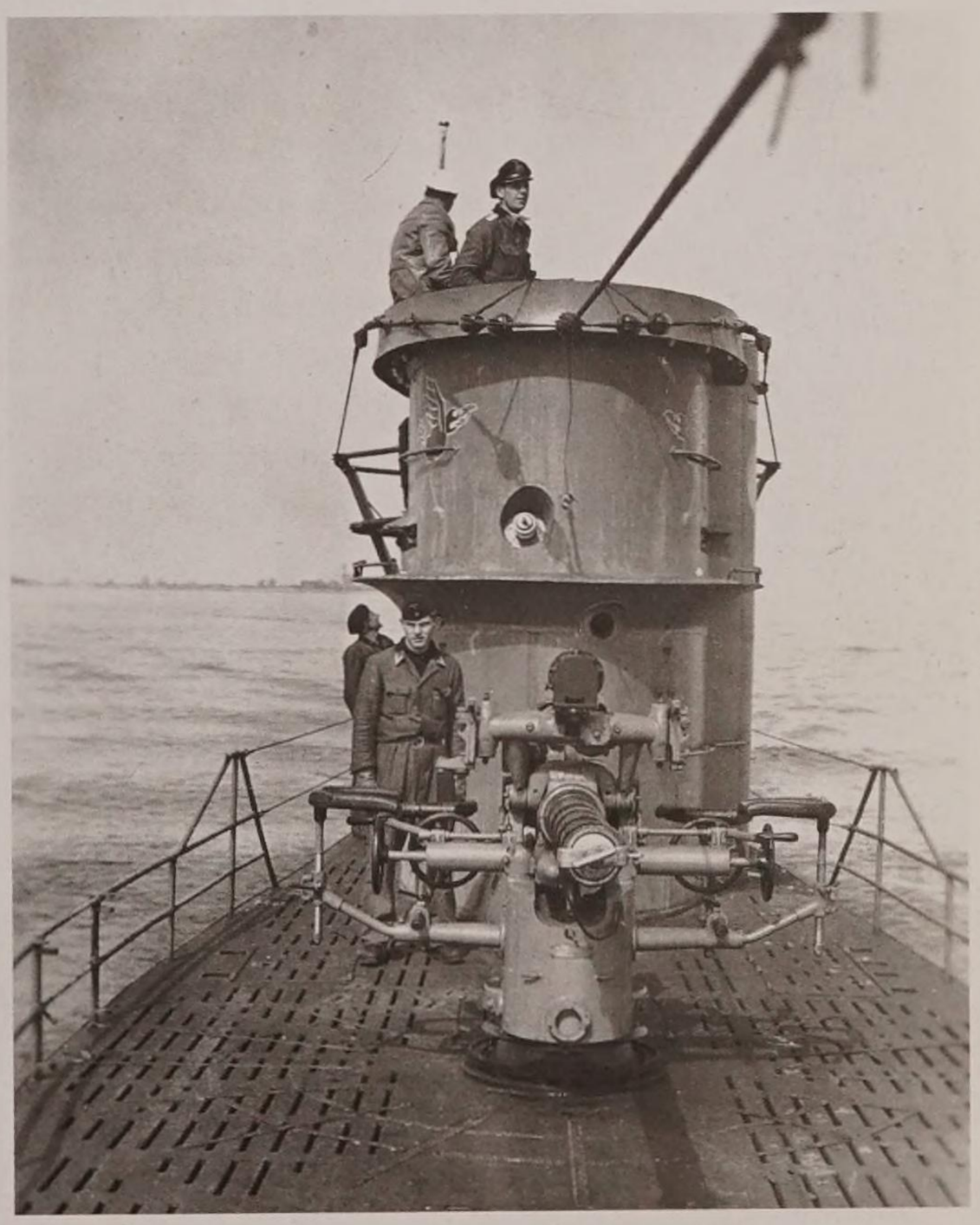
Crew quarters and conditions 128
Much ado about flushing 132
Time to eat 135
Christmas on patrol 137

140 Type VII in action

Surprise attack! 142
Prepare to crash-dive 144
Diving procedures 145
Achtung wolfsrudel! – beware wolfpacks! 146
U-boat aces of the deep 151

154 Bibliography

155 Index



ABOVE The view from the foredeck casing of Type VIIC U-661 (*Kapitänleutnant* Götz Baur) showing the deck gun, conning tower with watch officers on the bridge, and jumping wire running overhead. U-661 was scuttled by her crew in the Mediterranean on 12 November 1942 after suffering damage by depth charges from the Royal Navy corvettes HMS *Lotus* and *Starwort*. *(Through their Eyes)*

OPPOSITE Type VIIC U-boat U-552 (*Kapitänleutnant* Erich Topp) returns to its base at St-Nazaire on 6 October 1941 at the end of a patrol. Commissioned on 4 December 1940, U-552 sank 32 Allied ships on 15 war patrols totalling more than 165,000 tons. She survived the war to be scuttled by her crew on 2 May 1945. *(Bundesarchiv)*

Acknowledgements

A number of people have been kind enough to give me their time and share their knowledge about Type VII U-boats and the Kriegsmarine's war in the North Atlantic. Particular thanks go to:

Dr Jann M. Witt, historian at the Deutscher Marinebund (German Naval Federation) and his colleagues at the organisation's German Naval Memorial and the U-995 submarine museum in Laboe, Germany. A visit to this submarine, which is in near pristine condition, is highly recommended for both families and enthusiasts. It is easy to reach from Hamburg, via Kiel, and is the only place in the world where visitors can examine a Type VIIC/41 U-boat from stem to stern. Dr Witt kindly gave me access to the Deutscher Marinebund's extensive archive of U-boat material, including photographs and printed publications, along with a list of further recommended reading. He has invited me back to Laboe whenever I wish to return – but on one condition: I must learn German for my next visit! (www.deutscher-marinebund.de).

James Payne at his 'Through Their Eyes' military photo archive – www.throughtheireyes2.co.uk – which offers a treasure trove of images taken by servicemen from both sides in the two world wars. His photographs include an extensive section on U-boats. A visit to the website is recommended, but be prepared to invest several pleasant hours surfing through the wide range of available material, which will be time well spent.

Thanks also to Richard A. Hall in Glen Allen, Virginia, USA, for assisting me with information about artwork and symbols used on certain U-boat conning towers during the Second World War; Santiago Mata of Centroeuropa (www.centroeu.com) in Spain for supplying me with some excellent U-boat information and Eric Fogt at the Wartime Press (www.wartimepress.com) for information from 1944 copies of *Die Kriegsmarine* magazine.

Thanks, too, to Colonel French MacLean from The Fifth Field (www.thefifthfield.com) for allowing me to reproduce the Berlin hotel stationery signed by Günther Prien and the crew of the U-47 in October 1939; Jan Van Beemd in Deurne, Belgium; Coloptics in York and Greg Gardenour in Butler, Indiana, for additional photographic assistance. Special acknowledgement goes to J.T. McDaniel (www.jtmcdaniel.com) 'writer, editor, playwright, actor, philosopher and allround nice guy' from Dublin, Ohio, for his help in explaining how a submarine dives.

Thanks to the Bundesarchiv, Imperial War Museum and Merseytravel for permission to reproduce photographs in their collections. Last, but not least, my thanks to Jonathan Falconer from Haynes Publishing for commissioning this book from me and to my sharp-eyed editor, Michelle Tilling, for knowing the difference between millimetres and centimetres! It was good to work with you both once again.

Like everyone else interested in U-boats, I am indebted to data featured on the following excellent websites and strongly suggest that readers bookmark them for future visits (if you have not already done so!):

www.uboat.net
www.uboataces.com
www.uboatarchive.net
www.uboat-bases.com
www.subart.net
www.submarine-history.com

OPPOSITE Type VIIC/41, U-995, sole survivor of the Type VII class of U-boats. *(All photographs by the author or from the author's collection unless credited otherwise.)*

'The only thing that ever really frightened me during the war was the U-boat peril. But now our life-line, even across the broad oceans, was endangered. I was even more anxious about this battle than I had been about the glorious fight called the Battle of Britain.' – Winston Churchill, *The Second World War* – Volume II, *Their Finest Hour*.

Introduction

‘The Type VII was a comparatively small and very handy boat of 517 tons with a high action radius for its size and a comparatively high number of torpedoes (12–14). In the opinion of the U-boat command it was the ideal combination of tactical usefulness in attacks (light and easy to handle, difficult to see at night, small turning circle) and possessed the necessary fighting strength, expressed in action radius and armament.’

From *The Conduct of the War at Sea* by Grand Admiral Karl Dönitz, written in December 1945/January 1946 while awaiting trial for war crimes at Nuremberg.

OPPOSITE Out of the 703 Type VII class U-boats produced, only U-995 still survives and is now a public museum at Laboe, a pleasant seaside town near Kiel in German’s Schleswig-Holstein region. Type VII/41 U-995 was laid down on 25 November 1942 by Blohm & Voss, Hamburg, and commissioned on 16 September 1943.

ABOVE U-148 fights its way through rough Atlantic waters. *(US National Archives and Records Administration)*

ABOVE RIGHT A U-boat struggles through a North Atlantic storm, depicted by artist and illustrator Claus Bergen. This painting was exhibited at the 1942 Nazi-sponsored Great German Art Exhibition in Munich.

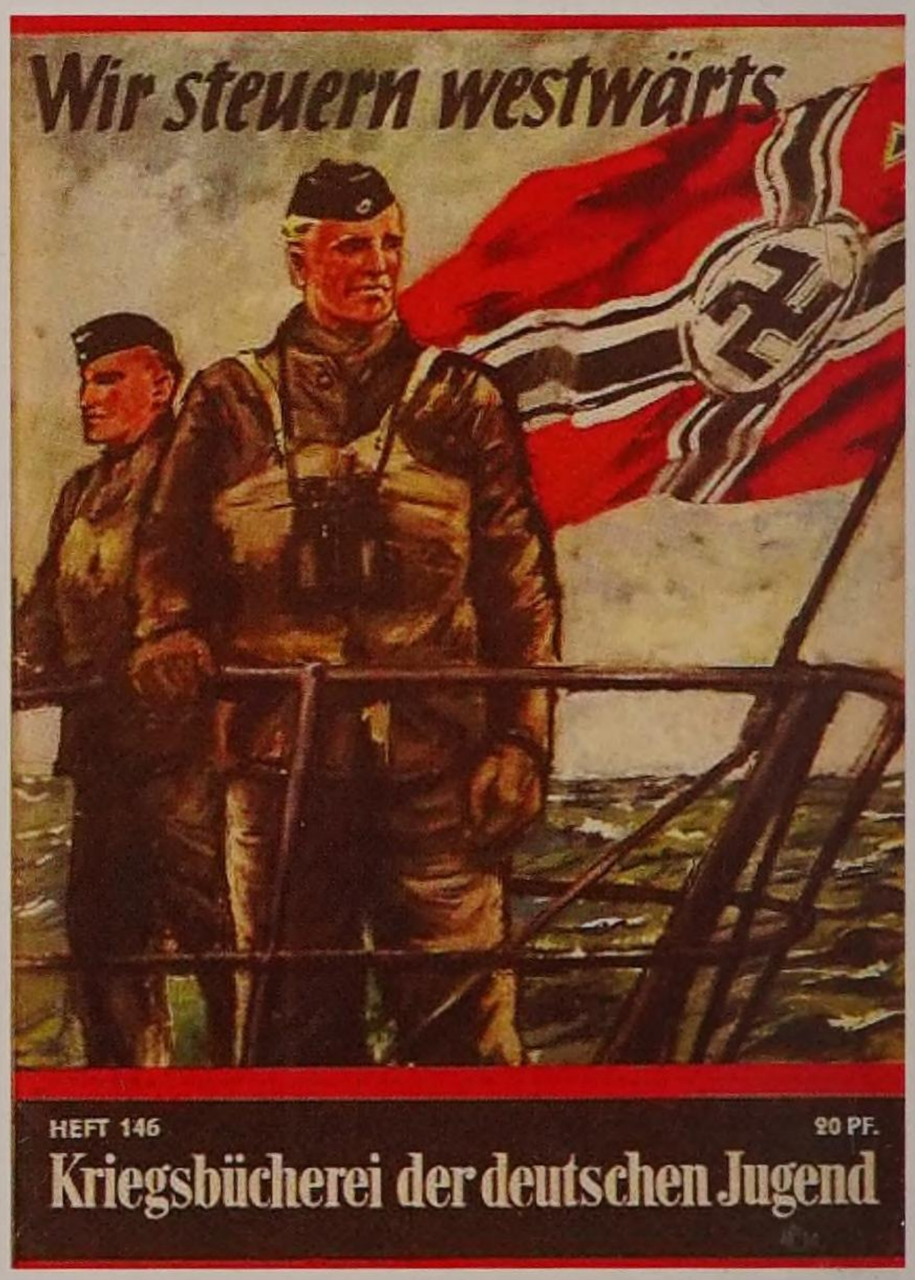
RIGHT A lone U-boat stalks the stormy waters of the North Atlantic looking for its prey. *(Library of Congress)*

FAR RIGHT *We're sailing westwards* is the name of an adventure book produced to encourage members of the Hitler Youth movement to join the Kriegsmarine's submarine service as soon as they were old enough.

The Type VII *unterseeboot* (submarine) was the classic workhorse U-boat of the Second World War and made up a large part of the German submarine fighting force taking part in the Battle of the Atlantic. This deadly killer machine – originally developed in the First World War – was based on a design by the Germany Imperial Navy. Over 15,000 British civilians died as a result of U-boat attacks between 1914 and 1918, making submarines one of the most formidable weapons of modern warfare and bringing Britain to within a hair's breadth of total collapse. Thanks to entry into the war by the United States, Germany was ultimately defeated.

The modified Type VII used in the Second World War was designed to run silent, run deep and unseen. One of its key jobs was to hunt out convoys bringing vital supplies across the Atlantic to help feed British people and provide them with the raw materials needed to keep their economy afloat. Their aim was to try to starve the British people into submission and make their lives as dangerous, difficult and uncomfortable as possible. In undertaking this work, the U-boat became the ultimate predator in the Battle of the Atlantic and in the waters surrounding the British coastline.

At the start of the war, British and Allied sailors serving on surface ships and submarines had little idea what a Type VII was. To them it was simply



a 'Jerry U-boat' and the very mention of that name sent shivers down their spines. The same fear also sat in the pit of every U-boat crewman's stomach in anticipation of the moment when an enemy depth charge might rip through their boat, sending its men to a watery grave.

The Type VII was the ugly face of the U-boat scourge which destroyed 730 British and Allied ships during the first 16 months of the war and nearly 1.5 million tons of merchant shipping alone between July and October 1940. It was designed for rapid attack and regarded by Germany's naval high command as the most supreme fighting submarine ever produced up to that time. German shipyards and factories worked around the clock with the aim of eventually producing 703 Type VII boats – the most-produced submarine class in history. By the close of the war in September 1945, U-boats had sunk 14.1 million tons of British and Allied merchant shipping and sacrificed 783 German submarines of all types to the deep. Over 39,000 officers and men served in the German U-boat-Waffe and all but 7,000 of them perished at sea.

This book attempts to help readers become better acquainted with the Kriegsmarine's Type VII class U-boats. In its pages you will find technical information covering dimensions, capacity and capabilities of each submarine in the class, the arms they carried, duties undertaken by crew members and how German submariners prepared for and undertook attack stations in the face of the enemy.

Readers will also go below deck and learn how U-boat crews often coped for up to four months at a time in damp, cramped, humid and stinking conditions – eating, socialising and sleeping next to, above and beneath torpedoes in the stormy waters of the North Atlantic, Mediterranean and the Arctic. You will discover how submarine crews became special heroes in the hearts of German people, the food they ate on board, how meals were prepared three times daily for over 40 crewmen in a tiny galley no bigger than a single-berth caravan and why Type VII submarines were equipped with two toilets – but only ever used one. . . .

So, if you are ready . . .

. . . *Achtung! Vorbereitung zum Tauchen!*
(Attention! Prepare to dive!)

ABOVE Heroes Day stamps. In February 1934 Hitler's National Socialists introduced a national holiday to commemorate the country's heroes. Known as *Heldengedenktag* (or Day of Commemoration of Heroes), the emphasis was on hero worship and over the next 11 years special postage stamps were issued celebrating Germany's military might, including the U-boat-Waffe, Wehrmacht (army) and Luftwaffe (air force). Pictured here are three stamps from 1941, depicting the submarine service in action. On the left, U-boat ace *Kapitänleutnant* Erich Topp of Type VII boat U-552 peers through his observation periscope to scan the sky and take navigational bearings. In the centre a U-boat is pictured departing from the scene of an attack, leaving a burning enemy ship in its wake. The right-hand stamp shows a group of 'torpedo boys' manhandling 'eels' on to a pontoon taking them out to a U-boat.

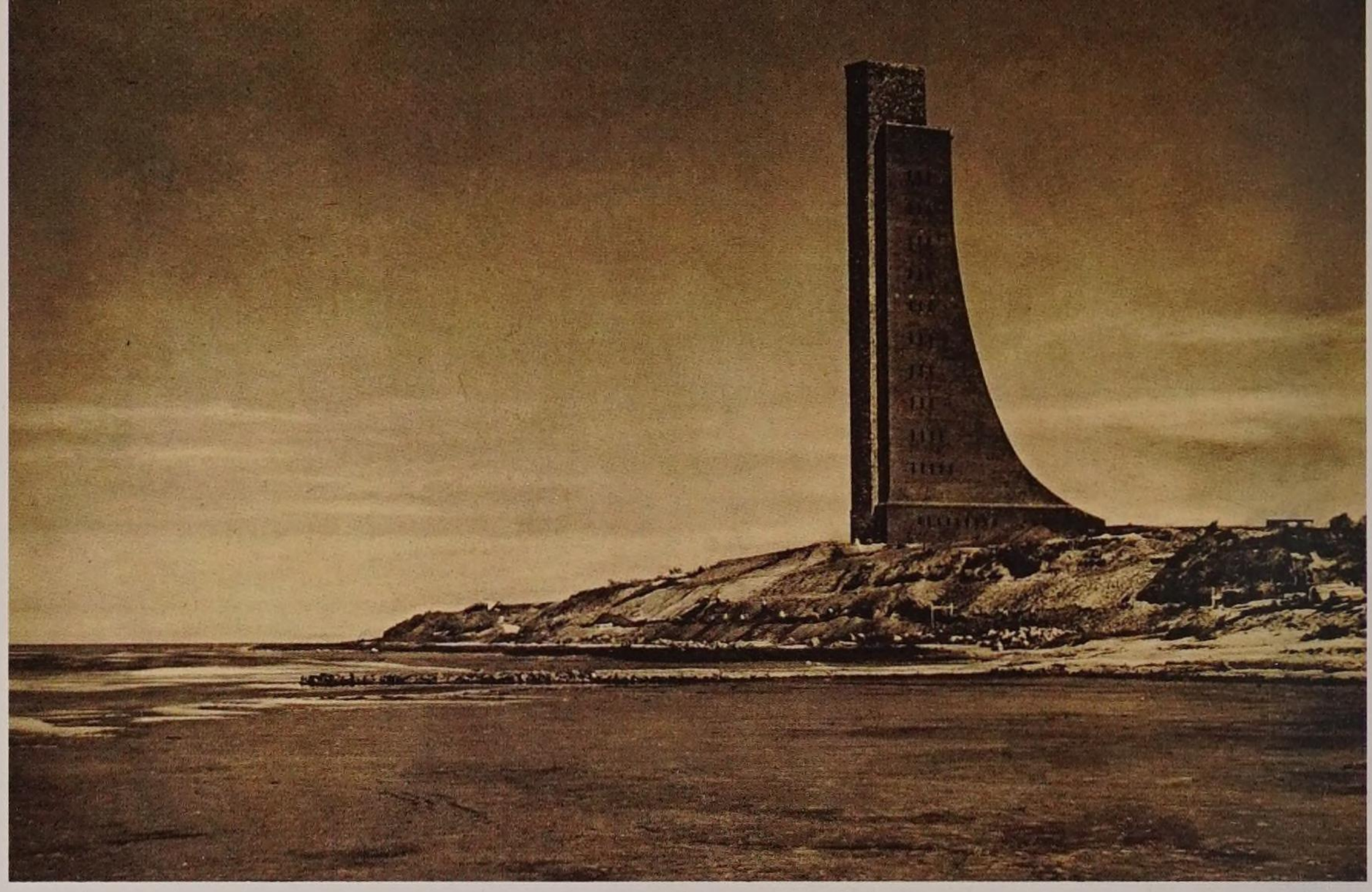
BELOW The U-boat War Badge was instituted during the First World War and awarded to U-boat crew members after completing three war patrols. The badge was worn on the lower left side of the uniform with the oval shape resembling a laurel leaf wreath. A U-boat lay across the centre and the German state crown (*Reichskrone*) was inlaid at the top centre of the wreath. In October 1939, the badge was reinstituted. It was similar to the original badge with the exception of the Prussian crown, which was replaced by a German eagle, a swastika and a more modern submarine. There were several ways to be awarded this medal, the most common being the completion of two war patrols running into months at a time. During the latter part of the war, U-boat losses were so great that many crewmen never made it past their second war patrol. The other occasion for its award was upon completion of an especially successful first patrol or having been wounded or killed in action. In the event of death, the badge was presented to the crewman's next of kin.

Chapter One

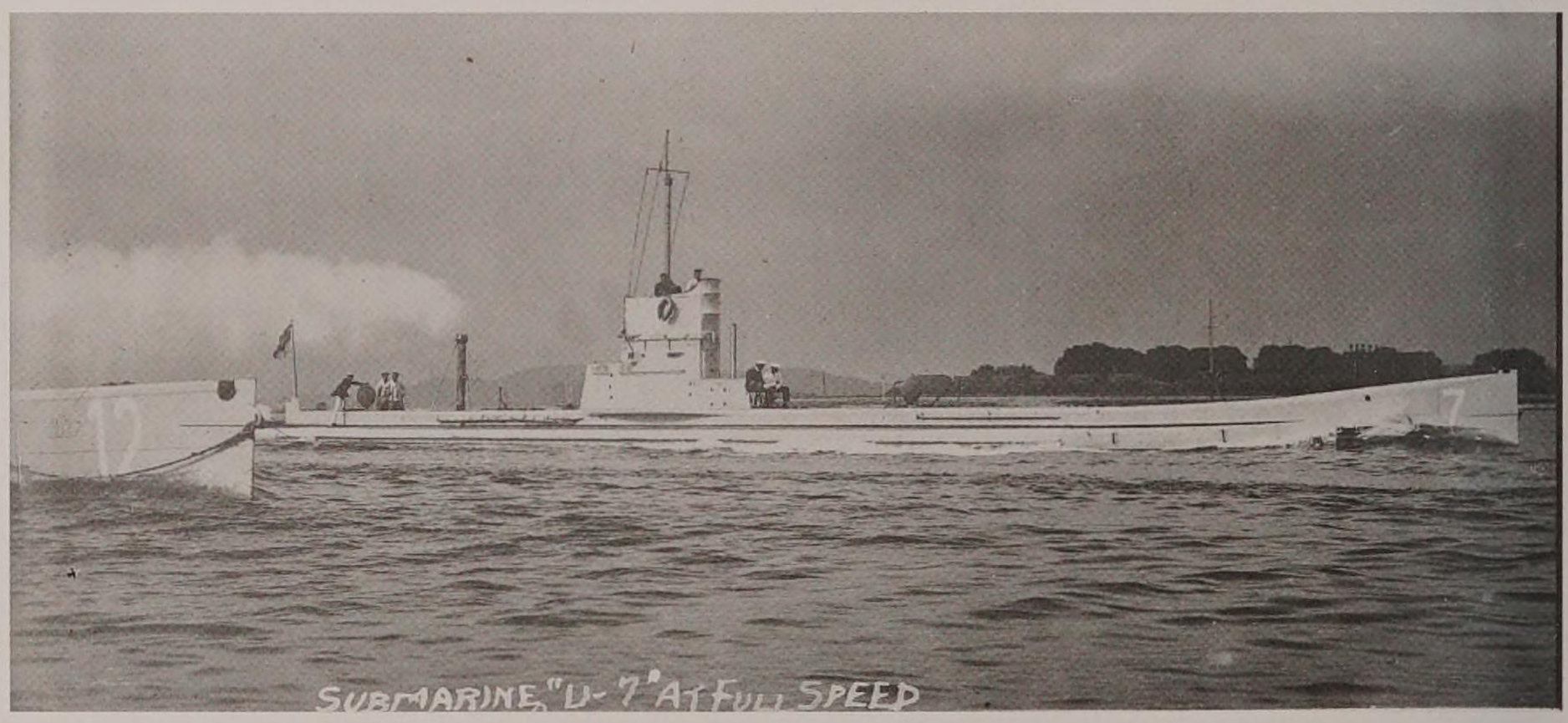
The U-boat story

Following its 1918 wartime defeat, Germany was ordered to hand over its entire submarine fleet to Britain – including boats still under construction – to be scrapped. Under the terms of the Treaty of Versailles, Germany's surface navy was limited to six battleships of less than 10,000 tons each, six cruisers and twelve destroyers. Article 191 of the treaty banned Germany from building any new submarines or buying them from foreign powers. The order stated: 'The construction and purchase of all underwater vessels, even for commercial purposes, is forbidden in Germany.'

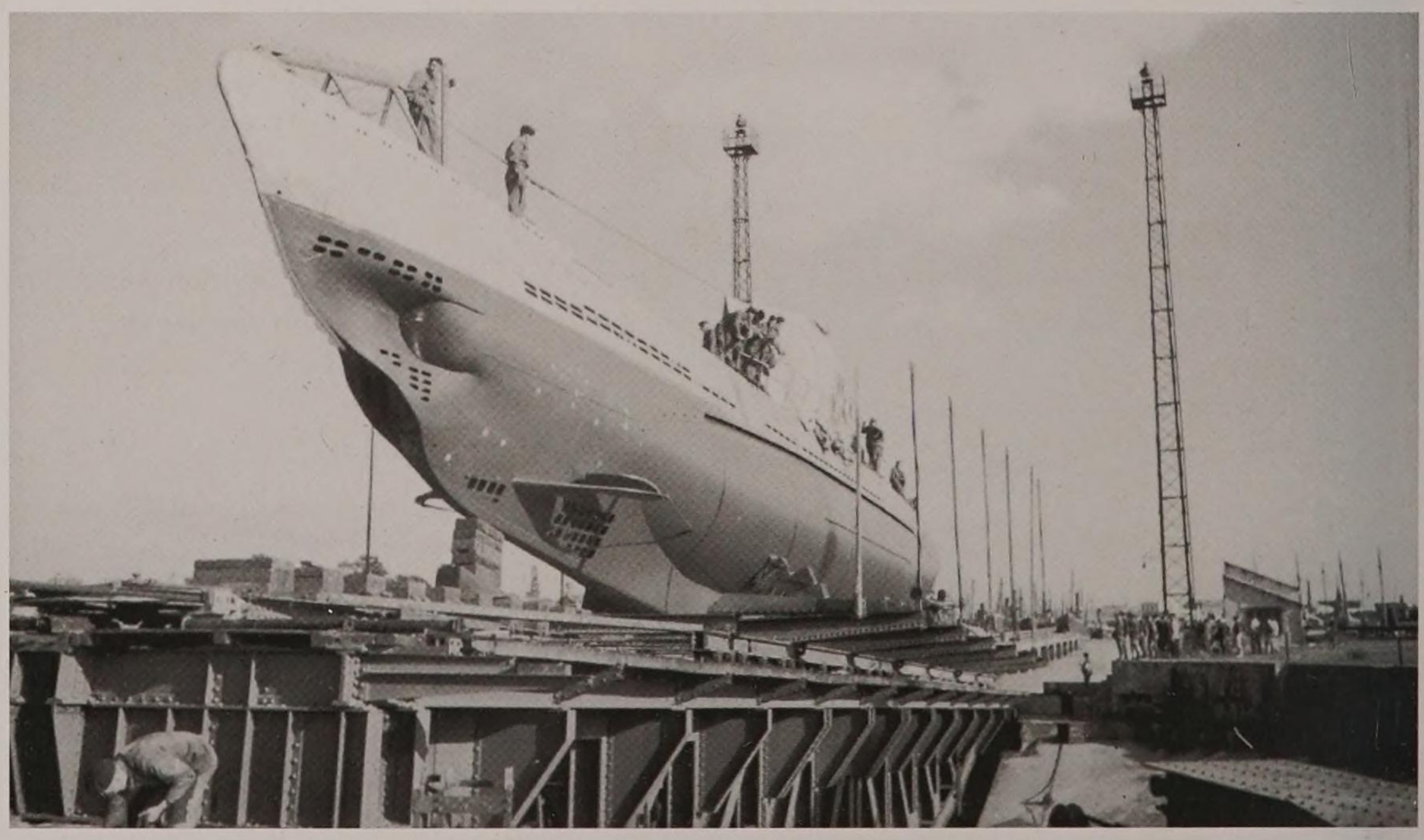
OPPOSITE Type VIIC U-boats were the most-produced class of submarine ever built.



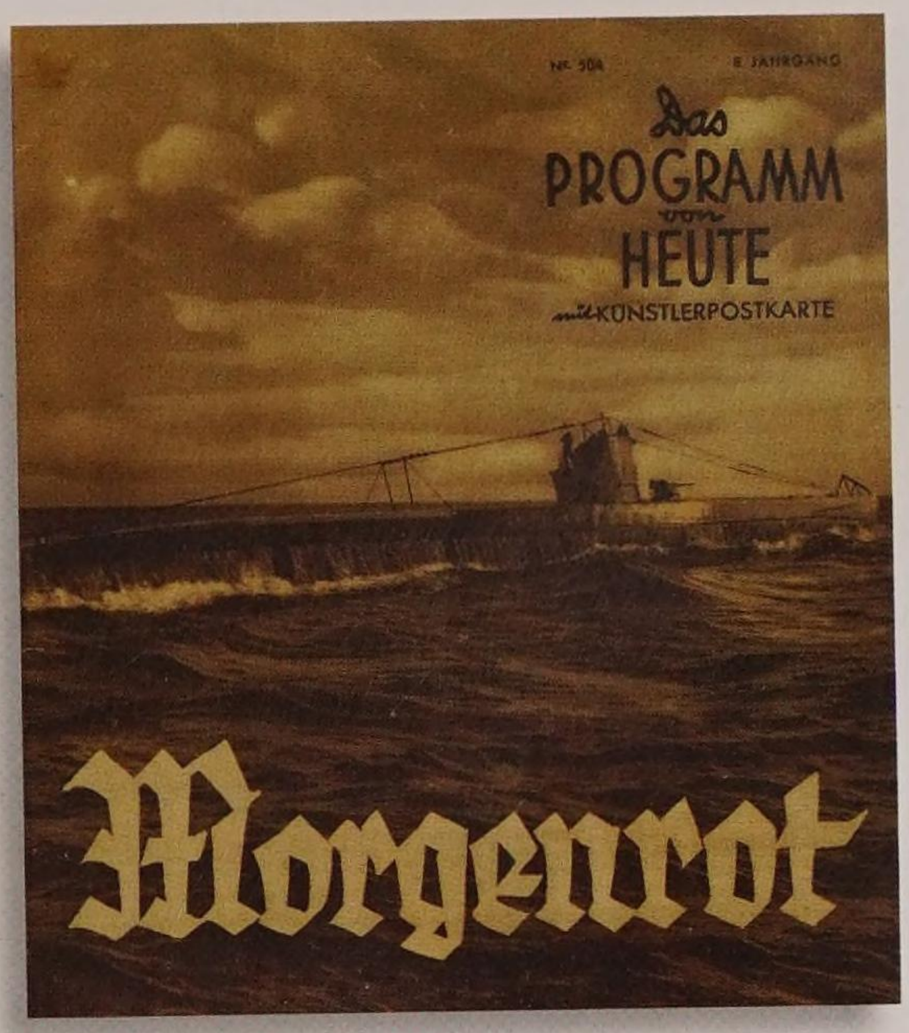
RIGHT A 1934 photogravure of the Naval Monument at Laboe, near Kiel, originally built to commemorate German naval personnel lost at sea during the First World War and whose final resting place could not be decorated with tombstones and flowers. Today it has become an internationally accepted peace monument for all sailors lost at sea from both world wars and is maintained by the Deutscher Marinebund, the German Naval Association. It is located opposite the U-995 museum boat. *(Ernst Scheel, Hamburg)*



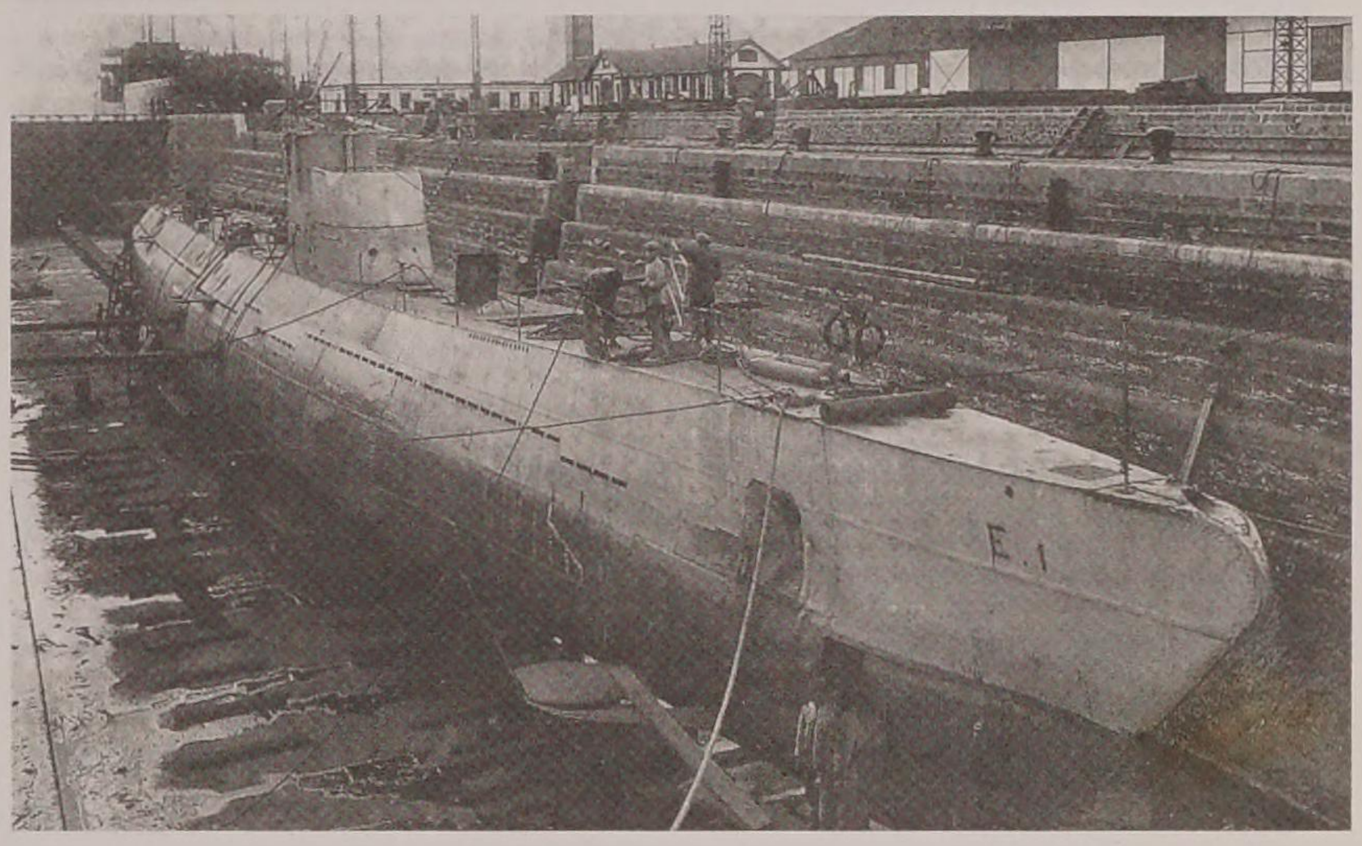
RIGHT Type U5 submarine, U-7, was built by Germaniawerft, Kiel, and launched in 1910. She made three patrols in the First World War before her career was cut short on 21 January 1915 when she was misidentified by U-22 off the Dutch coast and torpedoed. Only one crewman survived. *(US Library of Congress)*



RIGHT Type VIIA boat U-31 undergoes maintenance at Lorient. *(Bundesarchiv)*



RIGHT A programme cover for the 1933 German film *Morgenrot* (Morning Red) set during the First World War. Released three days after Adolf Hitler became *Reichskanzler* (Reich Chancellor), it was the first film to have its screening in Nazi Germany and became a symbol of the new times created by the Nazi regime. It was filmed in Kiel, Schleswig-Holstein, and became the first German submarine film produced after the First World War. The submarine's crew and commander were the heroes of the piece with the captain telling his men, 'Germans may not know how to live, but they know how to die.' In another scene, the commander informs his crew that he and the first officer will go down with the ship in order that the rest of the crew may escape, but they refuse on the grounds 'it will be all of us or none of us at all' and the commander glorifies the chance to die with such men – a common theme in Nazi-era films.

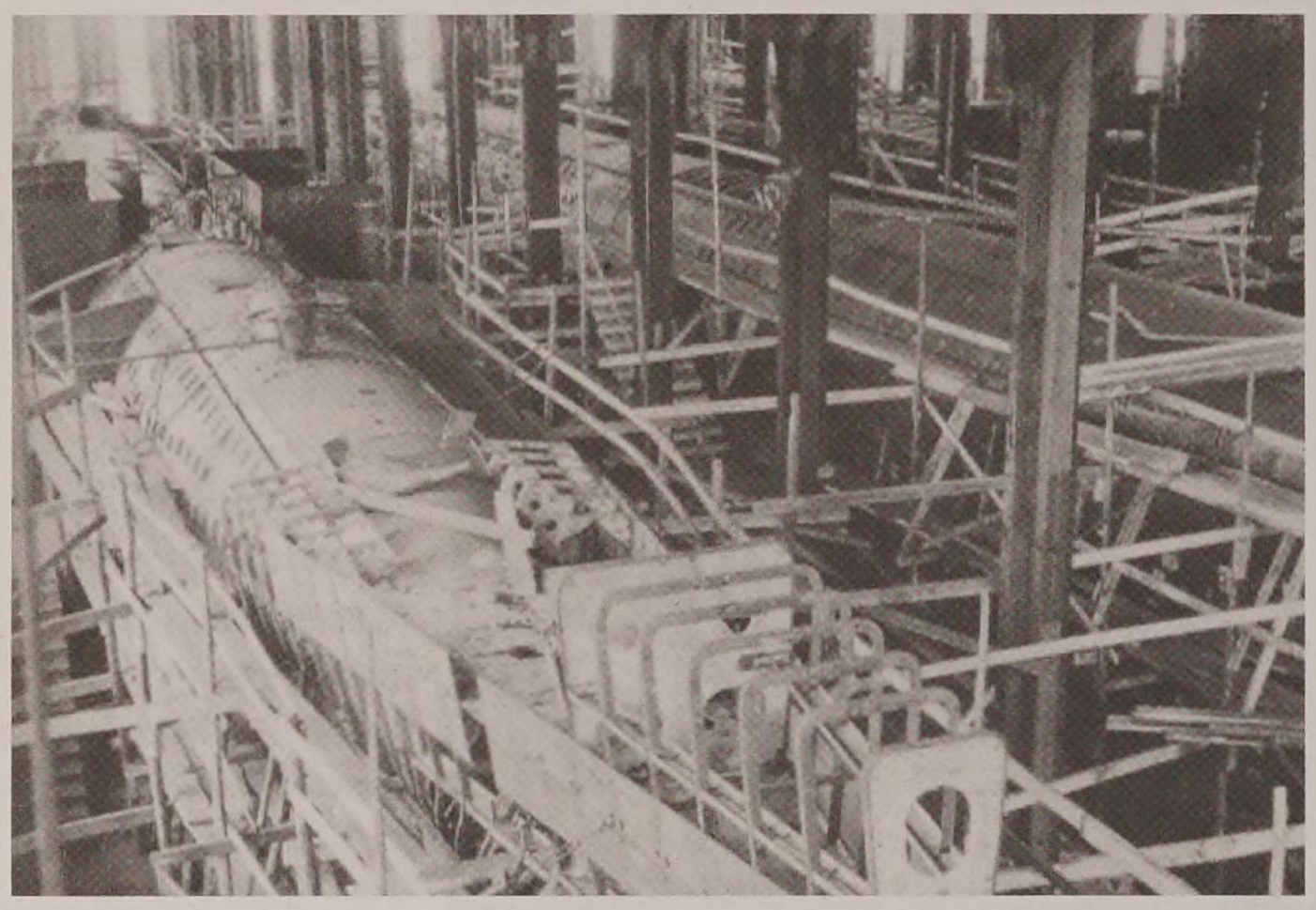


BELOW Submarine E-1, made in Spain in 1929/30 by Dutch- and German-owned 'dummy company' NV Ingenieurskantoor voor Scheepsbouw – IvS for short – and funded by German shipyards Aktien-Gesellschaft Vulcan Stettin (known as AG Vulcan) of Hamburg, Krupp-owned Germaniawerft, Kiel, and AG Weser in Bremen. *(Bain News Service/ Library of Congress)*

Germany's submarine design and building programme was far from idle in the inter-war years of 1918–39. A scaled-down programme continued in top secrecy flaunting the treaty's rules and agreements. In 1920, Kiel-based shipbuilding company Friedrich Krupp Germaniawerft quietly sold plans for a submarine cruiser to Japan where eight boats were subsequently built. Four years later the Japanese constructed three mine-laying submarines in partnership with Hamburg shipbuilder Blohm & Voss in a Kobe shipyard. The Argentinian government invited German submarine builders to Buenos Aires to supervise construction of ten boats as part of a consortium led by Friedrich Krupp Germaniawerft. In 1922, Italy, Sweden, Spain and Finland also availed themselves of German submarine expertise. All of these submarines were of German design but built outside the country.

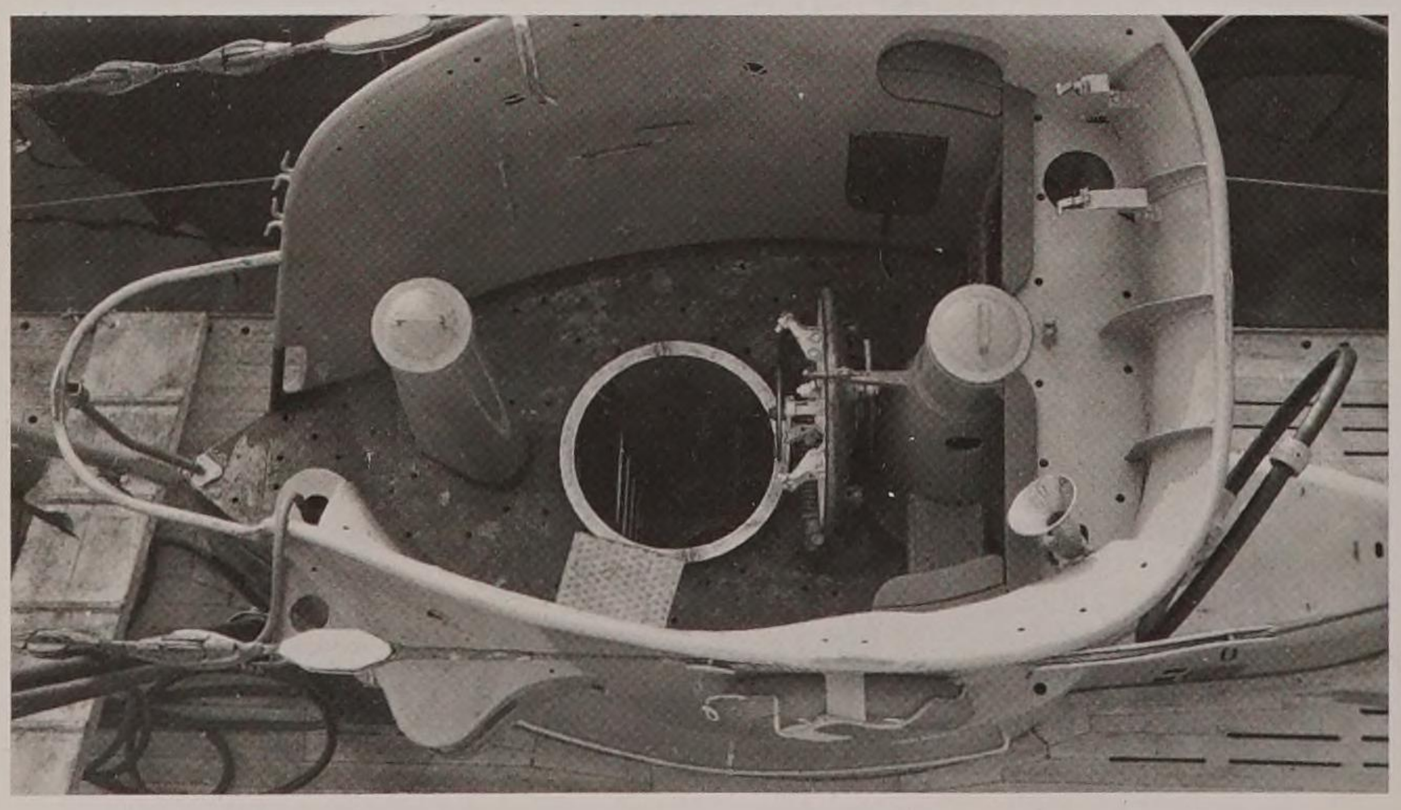
When Adolf Hitler became Chancellor in January 1933, he changed the name of Germany's navy from Reichsmarine to Kriegsmarine with Commander-in-Chief Grand Admiral Erich Raeder as its leader. Raeder was instructed to keep all U-boat construction plans under wraps and prepare a secret programme to re-establish what Hitler envisaged as the world's most powerful submarine fleet. Although the Treaty of Versailles forbade Germany from rearming, Hitler incorrectly insisted it did not forbid the country from resuming ship and submarine design and fabrication elsewhere. Although over 15 years had passed since submarines had been built in German yards, the country was still rich with men with experience from the First World War – a factor no treaty could obliterate.

An organisation was created with responsibility for designing and producing German submarines which circumvented limitations set by the treaty. The organisation, registered in the Netherlands as a 'dummy company', was called NV Ingenieurskantoor voor Scheepsbouw (which translates as Research on Engine-trial Vessels and known as IvS). It was intended to serve as a 'front'



ABOVE An organisation was created to design and produce German submarines, which circumvented limitations set by the Treaty of Versailles. The organisation was intended to serve as a 'front' for several companies while dishonestly concealing its German ownership. The company was set up as a joint venture by German shipyards and design work was undertaken by German partner companies. Submarines were built at Crichton-Vulcan's Finnish shipyards in Helsinki and Turku. Pictured here is a Type II U-boat on the Turku production line.

BELOW Looking down on to the bridge and conning tower area of Type IIA class submarine U-1, the first U-boat built following Hitler's abrogation of the terms of the Treaty of Versailles in 1935, which banned Germany from possessing a submarine fleet. U-1 was built at the Deutsche Werke shipyards, Kiel, and her keel laid on 11 February 1935 amid much celebration. She was completed on 29 June 1935 after a rapid construction period and operated by crews trained in the Netherlands. On 6 April 1940, U-1 sent a radio signal giving her position before she disappeared. The cause of her loss is unknown, but she was scheduled to sail through a minefield laid by the British submarine *Narwhal* that same day. She was the first of over 1,000 U-boats to serve during the Battle of the Atlantic, and one of over 700 to be lost at sea. *(Through Their Eyes)*



for several companies while dishonestly concealing its true ownership. It also prevented speculators from interfering with the holding organisation's plans.

The company was set up by the *Reichsmarineamt* (the old Imperial Naval Office) as a joint venture by German shipyards Aktien-Gesellschaft Vulcan Stettin (known as AG Vulcan) of Hamburg, Krupp-owned Germaniawerft in Kiel and AG Weser in Bremen. Design work was quietly undertaken by the German partner companies with submarines built at Crichton-Vulcan's Finnish shipyards in Helsinki and Turku. Some sections were manufactured in Schiedam in the Netherlands, Cádiz in Spain, Leningrad (St Petersburg) in Russia and Malmö, Sweden. Submarines manufactured included Soviet S-class boats and prototypes for submarines which eventually became Type II and Type VII models sold to Turkey, Spain, Finland, Sweden, Romania, Chile and Argentina.

Anyone passing the grounds of the Germania Shipyard and Deutsche Werke in Kiel in 1933 would have noticed that several prefabricated hangars had been erected, surrounded by security fences and armed guards. No one without written authority was allowed to pass through the gates to enter the area marked 'Experimental Motor Boats'. What took place inside the compound was top secret because behind closed doors Germany was illegally building the first of the 1,162 'forbidden' submarines for the Kriegsmarine.

These early boats took the form of 250-ton vessels designed for patrolling coastal waters and numbered U-1 to U-6. At the same time as the submarines were nearing completion, a new U-boat base was planned, Kiel-Dietrichsdorf, where component materials were gathered surreptitiously in preparation for the order to commence mass production.

Elsewhere in Kiel, IvS was assisting the Kriegsmarine to prepare a school for U-boat crews called *Unterseebootsabwehrschule* (Anti-Submarine Defence School), designed to teach skills including sea time and handling experience for officers, petty officers and enlisted men. The training school included a small fleet of eight 500-ton submarines. When orders to 'officially' recommence submarine

production was given, Deutsche Werke was instructed to get to work building two large 800-ton boats and two small 250-ton boats in 1934, followed by four small 250-ton boats in 1935 plus four large 800-ton boats and a further twelve 250-ton boats in 1936/37.

By 1933 there was still no German air force and the Kriegsmarine had still to 'officially' attain the strength allowed it under the Treaty of Versailles, having less than 15,000 men on its books. A bilateral Anglo-German Naval Agreement had been signed by both countries to regulate the size of the Kriegsmarine in relation to Britain's own Royal Navy. The agreement fixed a ratio whereby Kriegsmarine surface ship tonnage was to be no more than 35% of the Royal Navy's tonnage. Submarines, however, were to be an exception, providing tonnage did not exceed 50% of the Royal Navy's total submarine fleet. The agreement was legally registered in the League of Nations Treaty Series on 12 July 1935.

The agreement was an attempt by London and Berlin to improve relations, but it ultimately foundered due to conflicting expectations between the two governments. For Germany, the agreement was intended to mark the beginning of an Anglo-German alliance against the Soviet Union, but for Britain the agreement marked the start of a series of arms agreements designed to limit German expansionism.

Unaware that Germany was already building submarines in secret, the Anglo-German Naval Agreement gave the country legal right to build its navy beyond limits originally set by the Treaty of Versailles. Not that anyone in Britain was particularly worried at the time. As Grand Admiral Karl Dönitz later recalled in a 1946 essay he wrote to pass the time in prison while awaiting trial in Nuremburg:

Hitler was striving for a political agreement with England, having always regarded Bolshevik Russia as the arch enemy of Germany and Europe. None of the great naval powers, therefore, was considered to be among the future opponents of Germany. . . . This clearly showed that Germany did not reckon with a war against England, as she voluntarily renounced arming against English sea power.

LEFT Students at the U-boat Training Academy in Kiel are put through their paces by instructors. *(Acme Newspictures Inc., New York)*

The naval agreement was delivered to the London-based Ambassador Extraordinary and Plenipotentiary of Germany, Joachim von Ribbentrop, to be relayed onwards to Berlin. One of its clauses stated:

In the matter of submarines, Germany, while not exceeding the ratio of 35:100 in respect of total tonnage, shall have the right to possess a submarine tonnage equal to the total submarine tonnage possessed by the Members of the British Commonwealth of Nations. The German Government, however, undertake that, except in the circumstances indicated in the immediately following sentence, Germany's submarine tonnage shall not exceed 45 per cent of the total of that possessed by the Members of the British Commonwealth of Nations. The German Government reserve the right, in the event of a situation arising, which in their opinion, makes it necessary for Germany to avail herself of her right to a percentage of submarine tonnage exceeding the 45 per cent . . . to give notice to this effect to His Majesty's Government in the United Kingdom, and agree that the matter shall be the subject of friendly discussion before the German Government exercises that right.

RIGHT **A strong and sometimes stern taskmaster, *Großadmiral* (Grand Admiral) Karl Dönitz was admired by all ranks within the Kriegsmarine. He was a submarine man, too, and understood all that went with that honour.** *(Bundesarchiv)*

BELOW **U-boat ace *Kapitänleutnant* Fritz-Julius Lemp in discussion with Dönitz on the deck of U-110 at Lorient.** *(Bundesarchiv)*

'ONKEL KARL' – ADMIRAL KARL DÖNITZ

Karl Dönitz began his career in the Imperial German Navy before the First World War. In 1918, while in command of submarine UB-68, it was sunk by British forces and Dönitz was taken prisoner. While in a prisoner of war camp, he formulated what he later called *Rudeltaktik* (pack tactics, better known as 'wolfpack'). At the start of the Second World War, he was the senior submarine officer in the Kriegsmarine (German Navy) and by January 1943, Dönitz achieved the rank of *Großadmiral* (Grand Admiral), replacing Grand Admiral Erich Raeder as Commander-in-Chief of the German Navy (*Oberbefehlshaber der Kriegsmarine*). His 'wolfpack' submarine attack tactics were used extensively on convoys crossing the Atlantic, sending thousands of tons of Allied shipping to the seabed.

Although a strong and sometimes stern taskmaster, Dönitz was admired by all ranks within the Kriegsmarine's U-boat-Waffe. Like them, he too was a submarine man and understood all that went with that honour. He was highly visible, often to be seen waiting on the quayside for returning U-boats and crossing the gangplank to congratulate officers and crews on their successes at sea. He would shake the hand of every crew member and ask them questions about their experiences. It was on his recommendation that many U-boat commanders and their crews would be decorated. Dönitz was looked upon as a great leader by members of the submarine service, winning him the affectionate name of '*Onkel Karl*' (Uncle Karl). To others he was known as '*Der Löwe*' (the Lion).

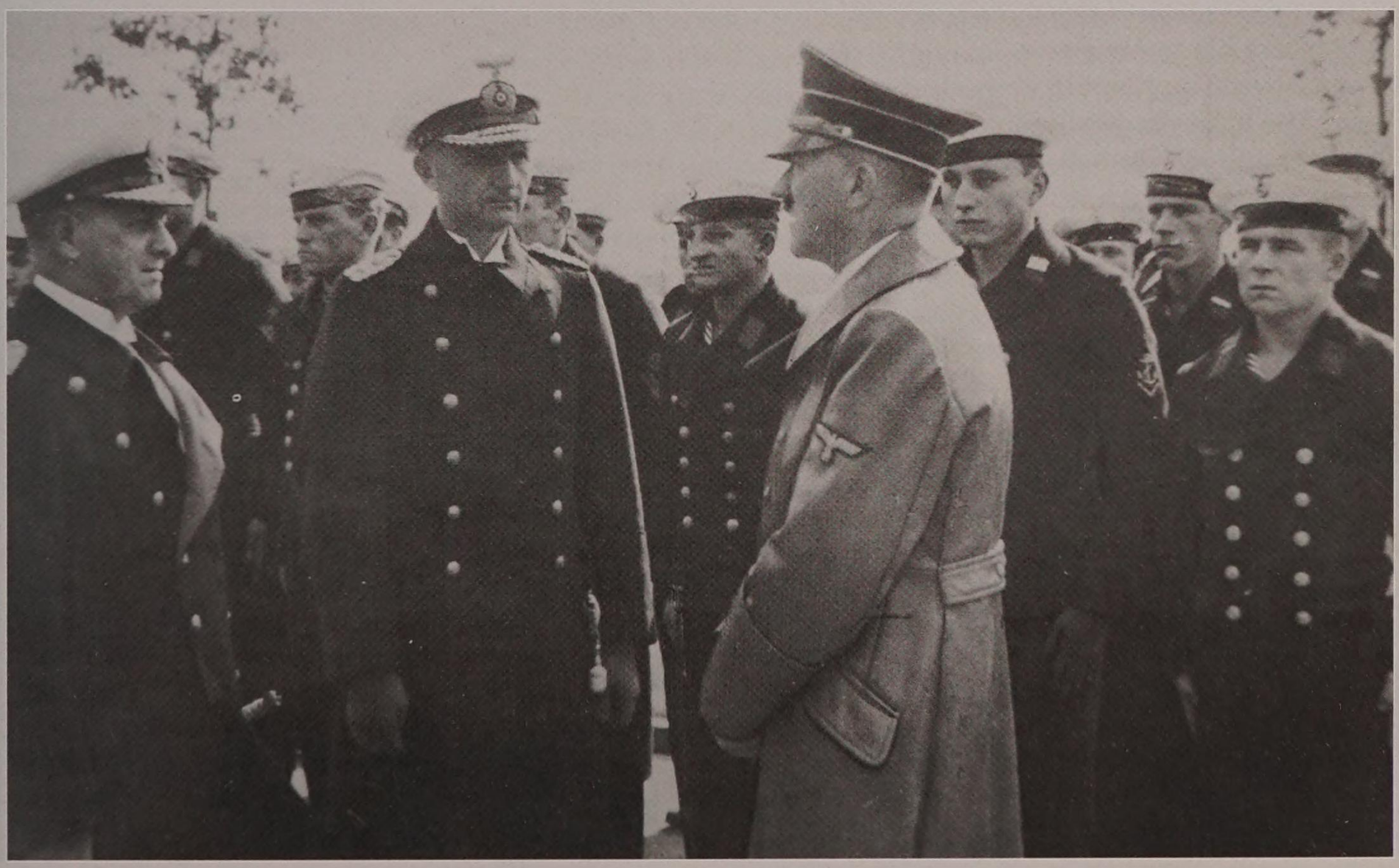
Following the death of Adolf Hitler on 30 April 1945 and in accordance with the Führer's last wishes, Dönitz was named his successor as *Staatsoberhaupt* (head of state), with the title of *Reichspräsident* (president) and Supreme Commander of the Armed Forces. On 7 May 1945, he ordered the Chief of the Operations Staff of the Armed Forces High Command, Alfred Jodl, to sign the German instruments of surrender in Rheims, France. Dönitz remained as head of the Flensburg government, as it became known, until it was dissolved by the Allied powers on 23 May.

ABOVE Dönitz confers with staff officers *Korvettenkapitän* Adalbert Schnee (left) and Dönitz's second in command Kapitän zur See Eberhard Godt (right) as they discuss the next phase of the U-boat war. *(Karl Parlour)*

Dönitz was later tried for war crimes and spent ten years in Spandau prison before being released in October 1956. He died in December 1980.

Despite strong feelings of loyalty towards Dönitz, not everyone admired him. Some ex-submariners felt he should have been hanged with other top Nazi leaders for recklessly sending so many young men to their early deaths. Writer Lothar-Günther Buchheim, author of the famous book *Das Boot* recorded that Dönitz 'has not a word of compassion in all his writing for the families of close to 30,000 young men whose tragically blind idealism caused them to fight and die in the longest battle of World War II – the Battle of the Atlantic'.

BELOW Dönitz meets Adolf Hitler, the man he would later replace as Germany's head of state on 30 October 1945 in accordance with the Führer's last will and testament. Dönitz was given the title of *Reichspräsident* (president) and Supreme Commander of the Armed Forces. On 7 May 1945, he ordered the signing of the German instruments of surrender in Rheims, France, and Dönitz remained as head of the Flensburg Government, as it became known, until it was dissolved by Allied powers on 23 May that year. He was indicted as a major war criminal in the trials at Nuremberg and was sentenced to ten years' imprisonment in Spandau. *(Karl Parlour)*

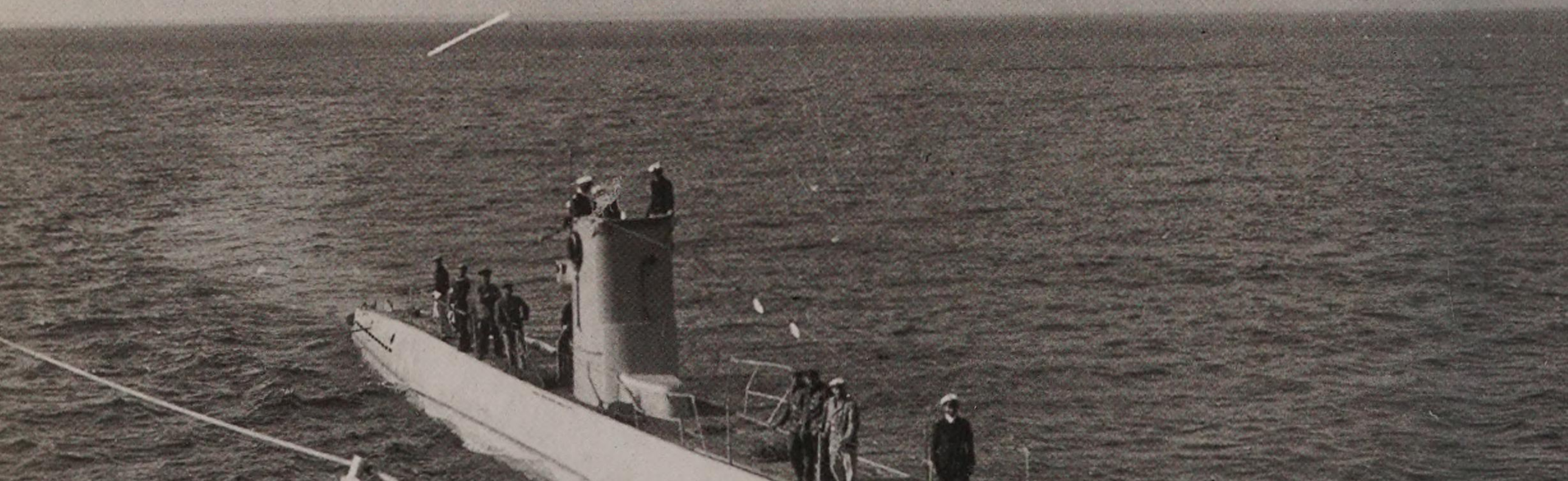


Although the original Treaty of Versailles had stripped Germany of its U-boats, the country had quietly begun rebuilding its armed forces. The pace of rearmament was accelerated under Hitler and the keel of Germany's first post-First World War U-boat was laid down on 11 February 1935 and commissioned in June of the same year. It was a Type U-II class boat designated with the number U-1 and was the first of 1,162 U-boats to be built up to U-4712 in 1945.

It was estimated by experts in London that if Germany ever needed to fight another war, the earliest it could be ready was 1942, owing to a lack of shipbuilding space, skilled shipyard workers, design problems, scarcity of foreign exchange to purchase raw materials and a shortage of steel and non-ferrous metals to build new vessels. A new German Navy was also regarded by Hitler as being third in importance in terms of the country's list of rearmament priorities. Top of Hitler's list was the rearmament of his army, followed by breathing new life into the Luftwaffe (air force). But by 1939 the Kriegsmarine was almost level-pegging in numbers of operational submarines with Britain's Royal Navy, having 56 boats in various stages of completion or commission.

As the spectre of another war loomed, the Kriegsmarine was busy producing five basic submarine types for its revitalised navy – all of them contravening sizes and capabilities covered by the original Treaty of Versailles. They included seagoing craft of 500–750 tons; ocean-going craft of 1,000 tons fitted out for minelaying; submarine cruisers of 1,500 tons; coastal craft of 250 tons and coastal minelayers of 500 tons.

The head of the Kriegsmarine, Grand Admiral Erich Raeder, and his senior submarine officer, Rear Admiral Karl Dönitz, instructed submarine commanders that Germany's policy regarding the use of U-boats and their weapons would commence as soon as war was officially declared. They were ordered to 'use all means to constrict Britain's vital supplies



BELOW U-1, Germany's first post-First World War submarine was a Type IIA class boat.

arriving via sea'. But at the outbreak of the Second World War, the Kriegsmarine was in no position to confront the might of Britain's surface sea power. Instead, the German Navy's most important task was to interrupt, prevent or cause as much hindrance as possible to sea communications operated by British- and Empire-registered merchant ships scurrying across the Atlantic carrying urgent supplies.

Raeder was shocked by the outbreak of war with Britain when it was declared on 3 September 1939. For Raeder, Dönitz and the Kriegsmarine, the war was at least five years too early. Raeder wrote in his war diary:

Today the war against England and France, which the Führer had previously assured us we would not have to confront until 1944 and which he believed he could avoid up until the very last minute, began. . . .

As far as the Kriegsmarine is concerned, it is obvious that it is not remotely ready for the titanic struggle against England. To be sure, the brief period of time that has elapsed since the Agreement of 1935 has witnessed the creation of a well-trained and well-conceived force of U-boats, of which approximately twenty-six are currently ready for Atlantic operations, but these boats are still far too few to exert a decisive influence upon the war. The surface forces, moreover, are so weak and so few in numbers vis-à-vis the British fleet that the only course open to them – presupposing their active employment – is to show that they know how to die gallantly and thereby to create the basis for an eventual rebirth in the future.

At the outbreak of war the Kriegsmarine's fleet of 26 U-boats comprised **Type I and II** boats originally built in secret, **Type IX** U-boats for use in the western and southern Atlantic zones and early models of the **Type VII** for use in North Atlantic and Mediterranean waters. U-boat construction was immediately increased and though previously the monthly output had been two to four boats, an upgraded programme called for production of 20–25 U-boats each month. A 21-month construction period was envisaged, meaning the new U-boat fleet would not be ready for delivery for a further two years.

LEFT At the start of the war, when Dönitz was the Kriegsmarine's senior submarine officer, *Großadmiral* Erich Raeder was Commander-in-Chief of the German Navy. In early 1942, the U-boat war, under Dönitz's command, began to overshadow Raeder, triggering a feud between the two men. After a series of failed military operations, especially during the Battle of the Barents Sea, Raeder was demoted to Admiral Inspector, a ceremonial office. Raeder intended to tell Hitler about the failure in the Barents Sea and explain it as series of misunderstandings. However, the message was not passed on and Hitler understood the battle had been a success. When Hitler discovered the truth, he summoned Raeder to explain himself. When Raeder arrived in Berlin Hitler gave him a piece of his mind and threatened to scrap the German surface fleet. On 30 January 1943 Raeder resigned, to be replaced by Dönitz.

LEFT Type IIA U-boat U-6 (1935–44) was originally used as a training boat. *(Through Their Eyes)*

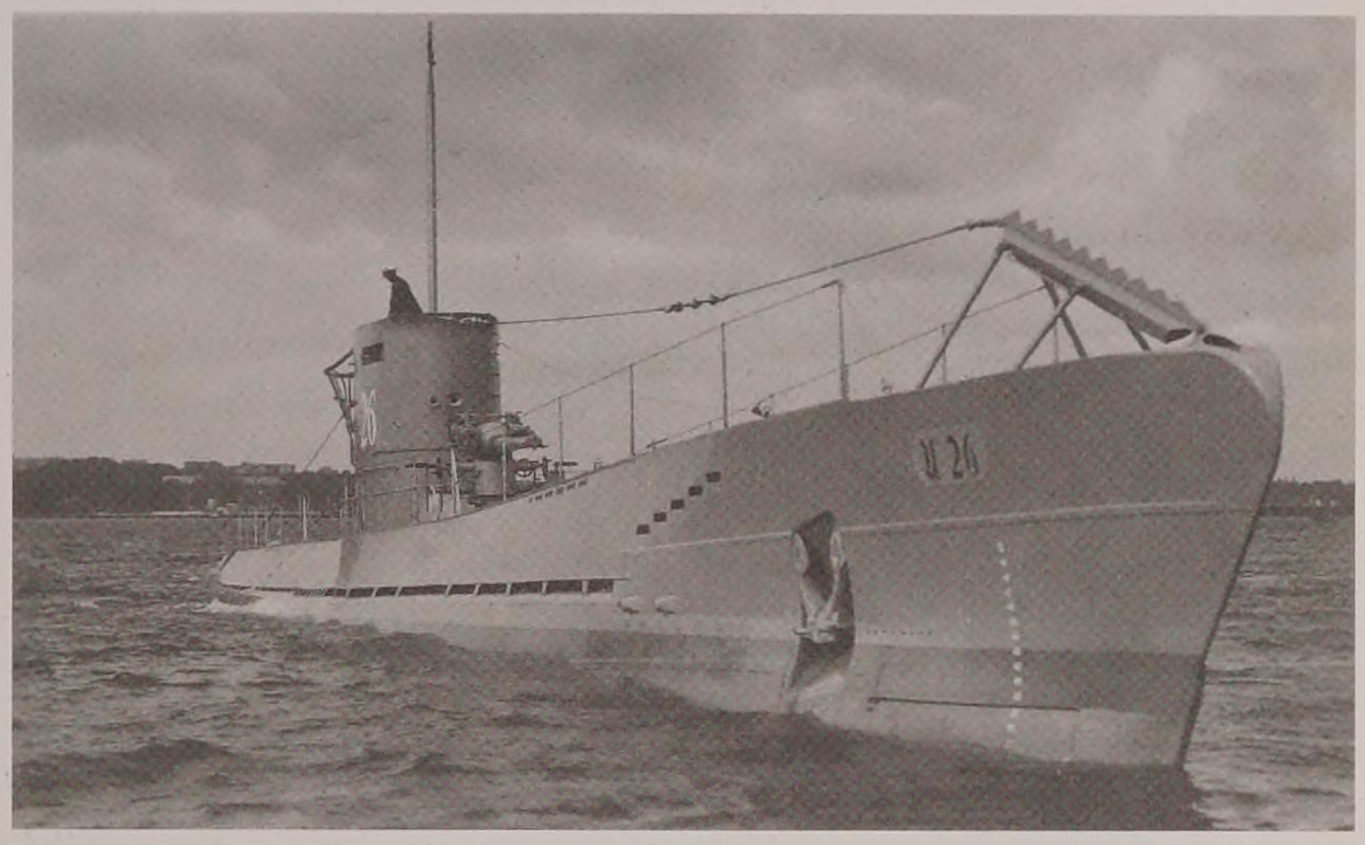
ABOVE Thirteen of the 20 Type IIB U-boats manufactured, delivered and ready for action. *(Through Their Eyes)*

It was clear to the Kriegsmarine that rearming its navy would be too late for a successful U-boat war. However, by 1942 the Kriegsmarine boasted the world's largest submarine fleet.

U-1 undertook its first patrol with a crew of German submariners trained in the Netherlands four years before the outbreak of war. The submarine quickly gained a reputation as being a 'poorly ship'. The speed of her construction, coupled with inadequacy of the technology used to build her, made her uncomfortable, leaky and slow. The original plan was to use Type II boats similar to U-1 for patrolling coastal waters. The boat displaced 254 tons and was equipped with a pair of diesel engines for propulsion on the surface and two electric motors for underwater movement. With a crew of 3 officers and 22 men, U-1 travelled at 13 knots on the surface and 7 knots submerged. It was armed with three torpedo tubes and a single 21mm gun.

Fifty Type II U-boats were finally built with modifications to improve stability and overall performance above and below water. In addition to 6 Type IIA boats, 20 Type IIB submarines were built along with 8 Type IIC and 16 Type IID models. Each type had advantages over previous models of the same class and became prototypes for larger submarines that would follow, equipped to dive more rapidly and be harder to spot thanks to low conning towers.

At 150m, U-1 and other Type II class boats had a shallow maximum depth and carried only five torpedoes. The boat also had a single hull and no watertight compartments. Subsequent variations – Types IIB, C and D – were similar in design to the original Type IIA but with greater range. Space inside remained limited with most of the crew living in the forward area around torpedoes, sharing 12 bunks; 4 bunks were also provided aft of the engines for engine room crew. Cooking and sanitary facilities were basic, and in this environment patrols of any length were arduous.



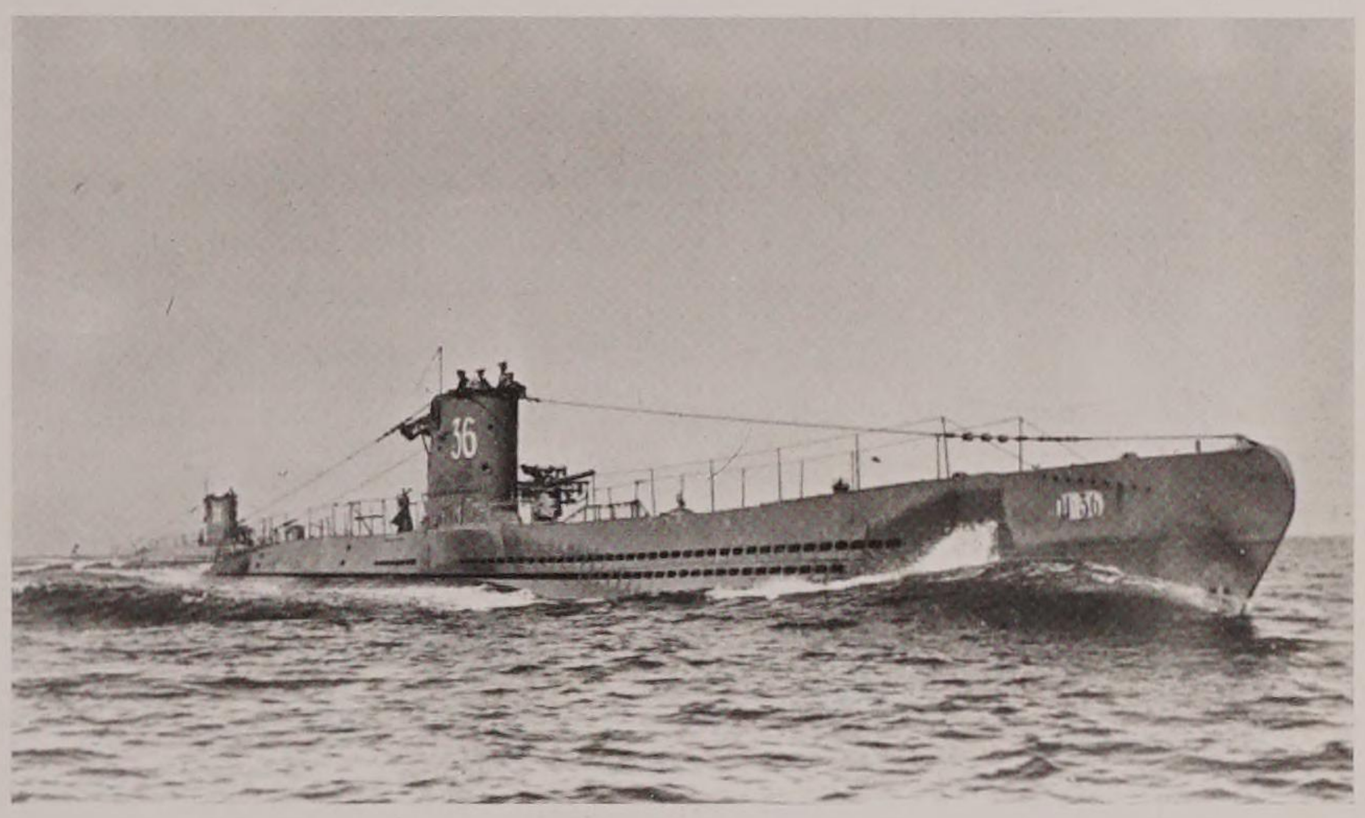
RIGHT U-26 was one of two Type IA U-boats produced by the Kriegsmarine in Bremen. U-26 was commissioned in May 1936 and experienced a short but successful combat career, sinking 11 ships before being scuttled south-west of Ireland after being damaged by depth charges dropped by HMS *Gladiolus* and an Australian Sunderland flying boat from No 10 Squadron RAAF. The submarine's crew of 48 men all survived.

Type 1A boats U-25 and U-26 were the first post-First World War attempt by the Kriegsmarine to produce ocean-going submarines. The first of only two models – and first to be given a 'Type' designation – U-25 and U-26 were commissioned in 1934 at a cost of 4,500,000 Reichsmarks each and came off the Bremen production line in February 1936, built by Deutsche Schiff und Maschinenbau Aktiengesellschaft – Deschimag for short – a conglomerate of several German shipyards.

Type 1A boats were 72.39m long, with a 6.21m beam and 4.3m draught. They were powered by two MAN M8V40/46 8-cylinder diesel engines with 2,900–3,080shp (2,200–2,300kW) and two BBC GG UB720/8 double acting electric motors with 1,000shp (750kW). They could travel at speeds between 17.7 and 18.6 knots on the surface and 8.3 knots submerged, with a range of 14,600km when travelling on the surface and 144km submerged. Maximum depth was 200m.

U-25 and U-26 carried crews of 4 officers and 39 enlisted men in confined spaces that were uncomfortable, claustrophobic and were to set a trend for a lack of comfort which became the hallmark of many wartime U-boats. This overall design was also a failure and during sea trials both boats proved to have poor seaworthiness, manoeuvrability and a slow dive rate. They were also mechanically unreliable. Production of further boats was scrapped in 1936.

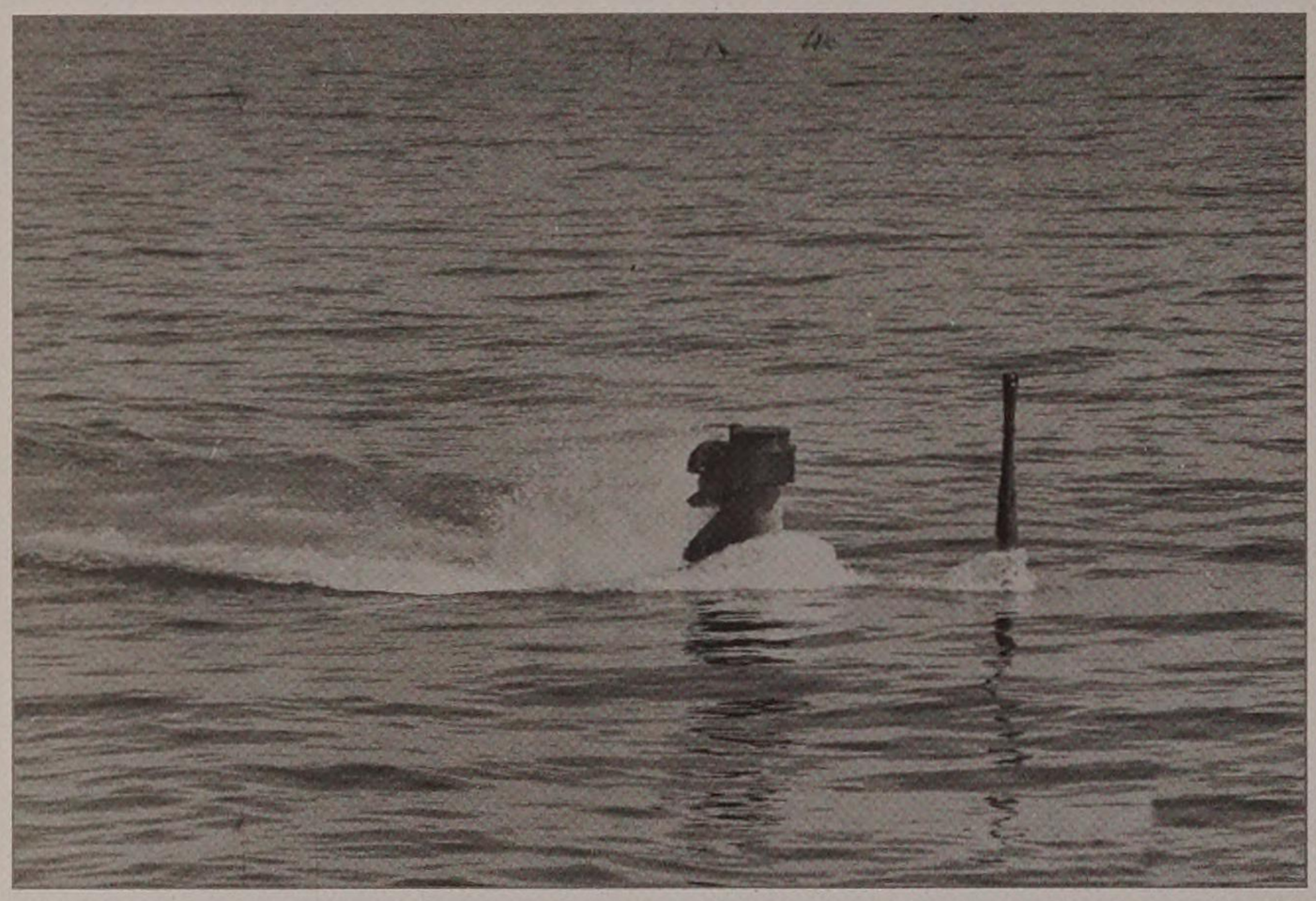
Initially both boats were used as training vessels but in 1940 they were called into combat duty. U-25 participated in five war cruises, sinking eight enemy ships including six British freighters. On 3 August 1940, while on a minelaying mission off the coast of Norway, the boat struck a mine and sank with all hands on board – possibly a victim of one of its own mines.



U-26 took part in eight war patrols, sinking three merchant ships and damaging one British warship during its first mine-laying mission. On its second patrol it became the first U-boat during the Second World War to enter the Mediterranean. U-26 took part in three other war patrols, sinking a further four merchant vessels. On its eighth patrol, the boat sank three merchantmen and damaged another ship. The attack led to severe depth-charging by two British warships. Unable to dive, U-26 was forced to the surface where she was bombed by a Sunderland flying boat. The 48-man crew scuttled their submarine and were rescued by Allied warships.

Type VII submarines were the first in a new generation of German assault boats and became the classic submarine of the Second World War. They were formidable combat machines, ideal for mass production and covering six major variants, each improving upon the limitations of the previous design. Out

ABOVE U-36 was a Type VIIA class boat, constructed during the U-boat-Waffe's earliest days at Kiel in 1936. It served in the pre-war German Navy in the Baltic and the North Sea. During the war, U-36 undertook two patrols, but was sunk by a torpedo fired by HMS *Salmon* and was lost with its crew of 40 on 3 December 1939.



ABOVE A U-boat snorkelling at periscope depth (around 7.5m).

DAS SCHNÖRCHEL (THE SNORKEL)

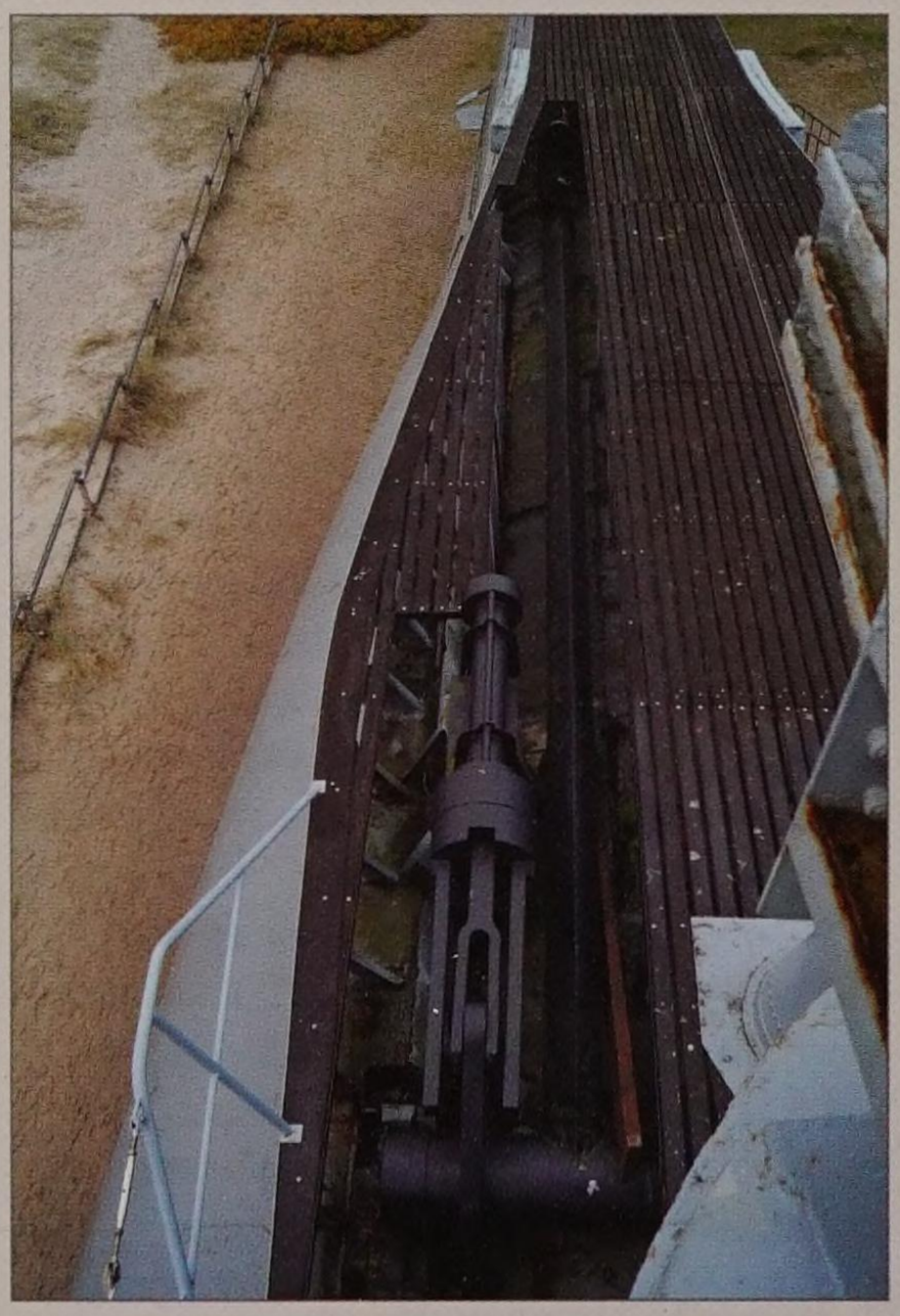
Until the advent of nuclear-powered submarines in the 1950s, submarines were designed to operate on the surface most of the time and only submerge for evasion or daylight attacks. But in 1940, and under the cover of night, U-boats were safer on the surface than submerged because Allied ASDIC sonar could detect boats underwater but were useless against surfaced vessels. With improved methods of radar detection, U-boats were forced to spend more time underwater running on electric motors that gave speeds of only a few knots and limited endurance.

When Germany defeated the Netherlands in 1940 they captured two Dutch submarines. The Dutch O-21 series was operating a device known as *snuiver* (sniffer). As early as 1938, the Dutch Navy had been experimenting with a simple pipe system that enabled their submarines to travel at periscope depth, operating on diesel engines with almost unlimited underwater range, while charging their propulsion batteries.

The Kriegsmarine first viewed what they renamed the ***Schnorchel*** (snorkel) as a means to take in fresh air down to U-boat engines through one tube while a second tube allowed diesel exhaust to be expelled upwards. By 1943 more U-boats were being lost, so the snorkel was retrofitted to the VIIC and IXC classes and designed into new XXI and XXIII types.

The first Kriegsmarine boat fitted with a snorkel was Type IIC boat U-58 which experimented with the equipment in the Baltic Sea during the summer of 1943. Boats began to use it operationally in 1944, and by the middle of the year half of the U-boats stationed at Bay of Biscay bases had snorkels fitted.

On Type VII U-boats the snorkel folded hydraulically forward from its housing on deck



RIGHT AND FAR RIGHT The snorkel on Type VIIC class U-boats were installed late into the war on the portside foredeck and housed in a special recess. To the left is the 'arm' which raised and lowered the snorkel, while the snorkel itself – containing pipes for expelling foul air from the diesel engines and drawing fresh air down into the submarine – is to the left.

to a vertical position and stored in a recess on the port side of the hull when not in use. XXI and XXIII types both had telescopic masts that rose vertically through the conning tower close to the periscope.

Snorkels created numerous problems for U-boats and their crews. Boats with a snorkel raised were limited to a speed of 6 knots to avoid breaking the tube. For crews, snorkelling was agony. Whenever a wave hit the valve at the tip of the snorkel, the air supply to the diesels was shut off and engines satisfied their need for oxygen by draining air directly from the boat's interior. This made many crew members writhe in agony as their eardrums burst.

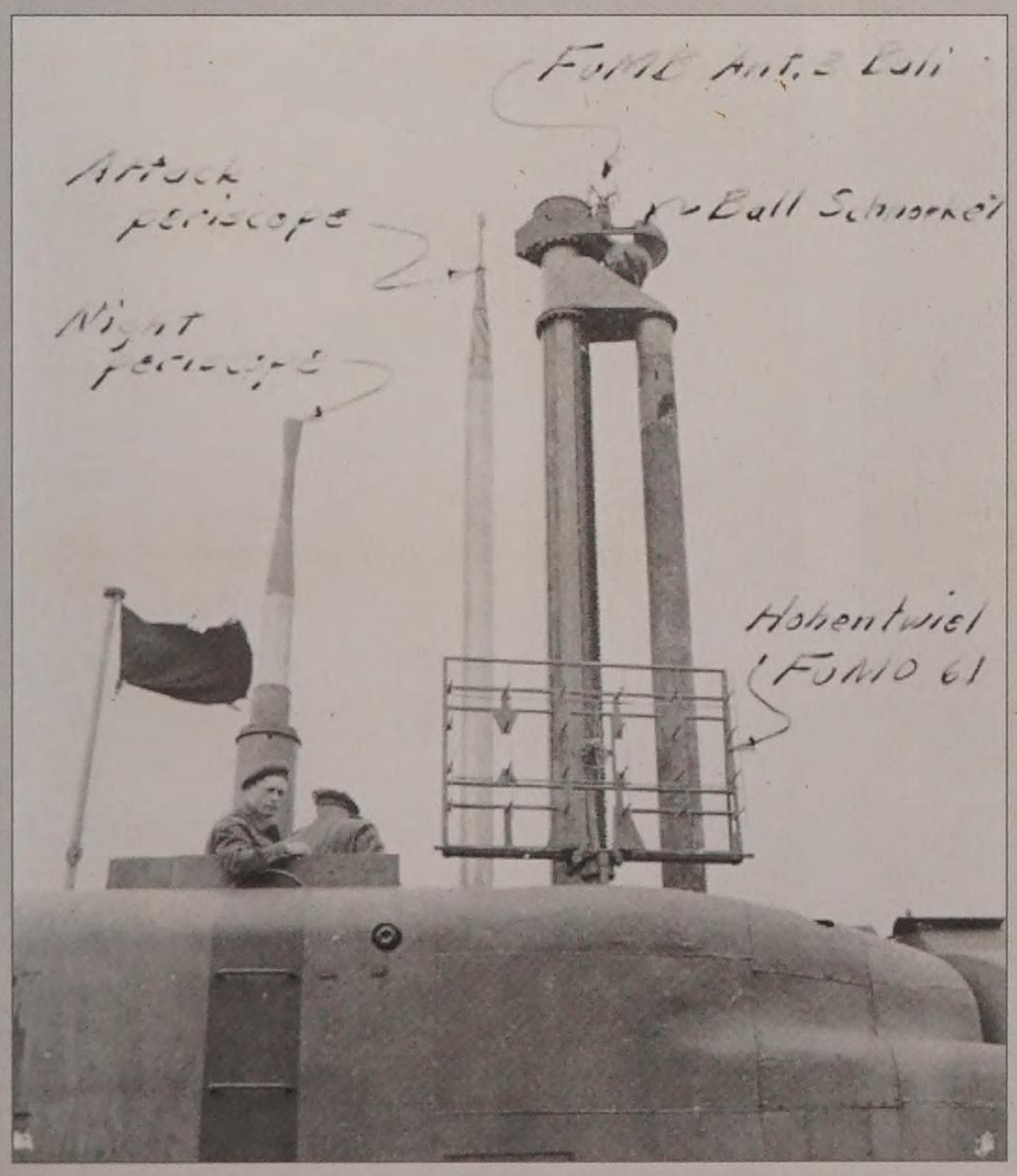
It was impossible to use the snorkel during daylight hours because the tip with its valve produced a rippling wake clearly visible from the air and its exhaust fumes acted like a signal to passing Allied aircraft.

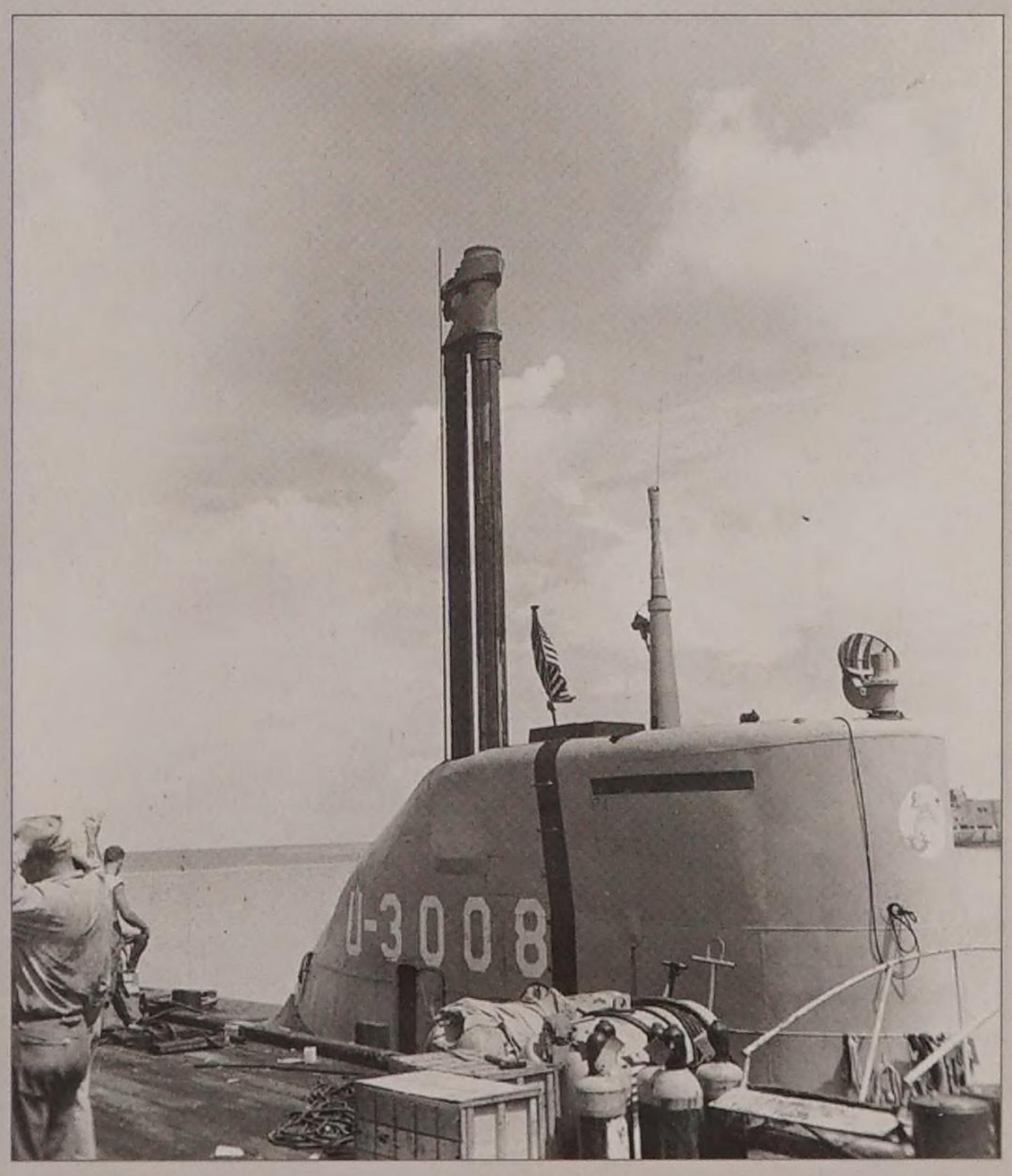
When U-boats started falling prey to enemy aircraft, Dönitz issued a formal order prohibiting any further deployment in the Atlantic of U-boats with snorkels. But in the last weeks of the war, he was so desperate to turn the tide in favour of Germany that all submarines – with or without snorkels – were sent out in a vain attempt to win the war at sea for Adolf Hitler.

ABOVE Type XXI boat U-2513 with snorkel ball, photographed off the coast of Florida, September 1948. *(US National Archives)*

BELOW LEFT Type XXI boat U-3008's conning tower, showing periscope, snorkel and raised antennas. The photograph was taken after the submarine surrendered to US naval forces at the Portsmouth Naval Shipyard, Kittery, Maine, on 30 August 1946. *(US National Archives)*

BELOW RIGHT Captured U-boat U-3008 in American hands at Key West Naval Station, Florida, on 25 July 1947. The boat's snorkel has been raised. *(US National Archives)*



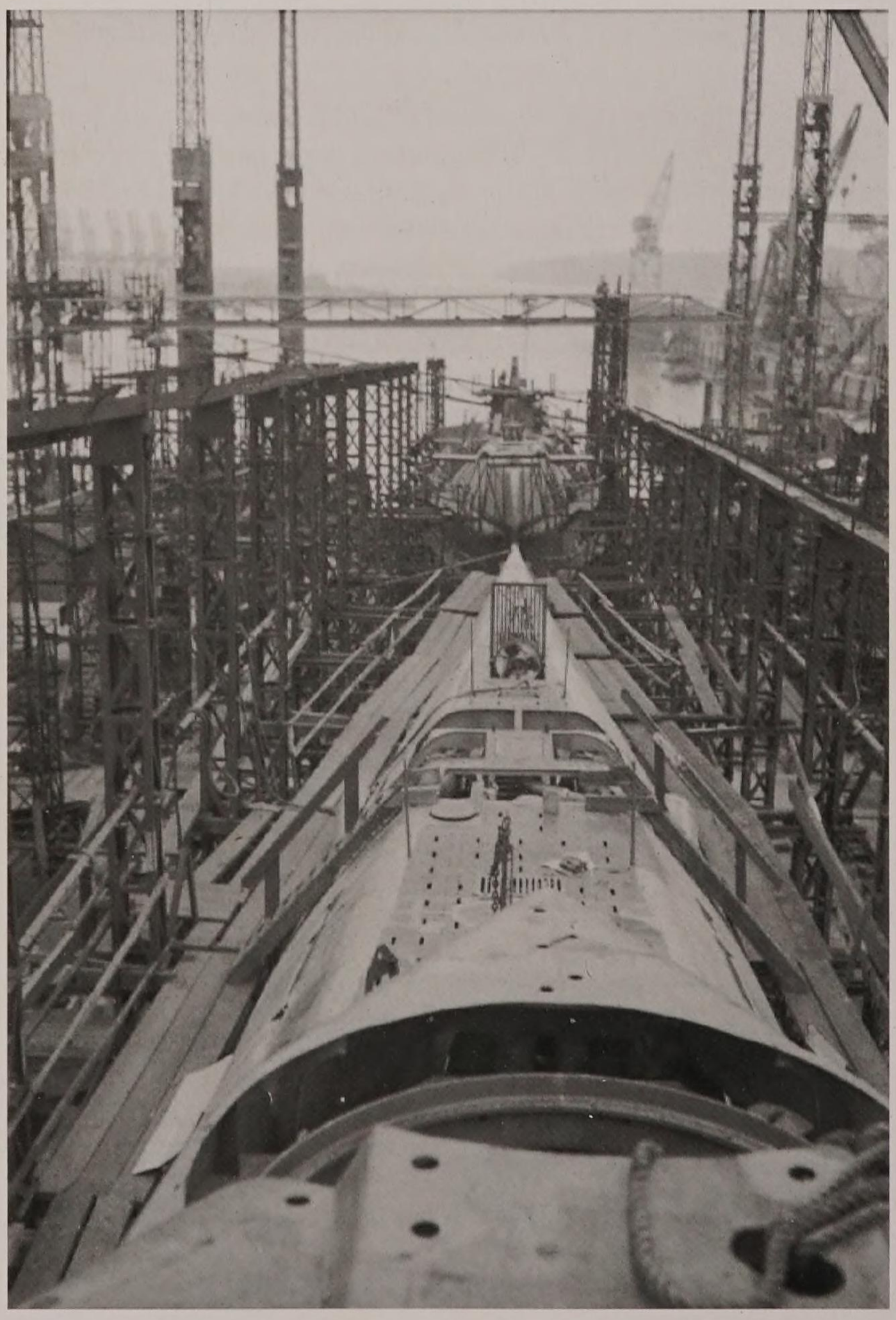


of 1,156 U-boats constructed between 1935 and 1945, 703 of them were Type VIIs.

Type VIIs were double-hull attack boats with an inner pressure hull covered by a light outer casing, giving the vessel a ship-like form optimised for surface navigation. They were powered by two shaft diesel/electric motors and the submarine's performance was generally good, allowing Type VIIA models to dive to a depth of 220m. The boats also had improved striking power compared with Type II submarines, with 5 torpedo tubes and space for 11 torpedoes on board or 22 TMA (Target Motion Analysis) mines. Early models also carried 88mm fast-firing deck guns which could handle 160 rounds of ammunition and were later replaced by different deck guns as the war progressed.

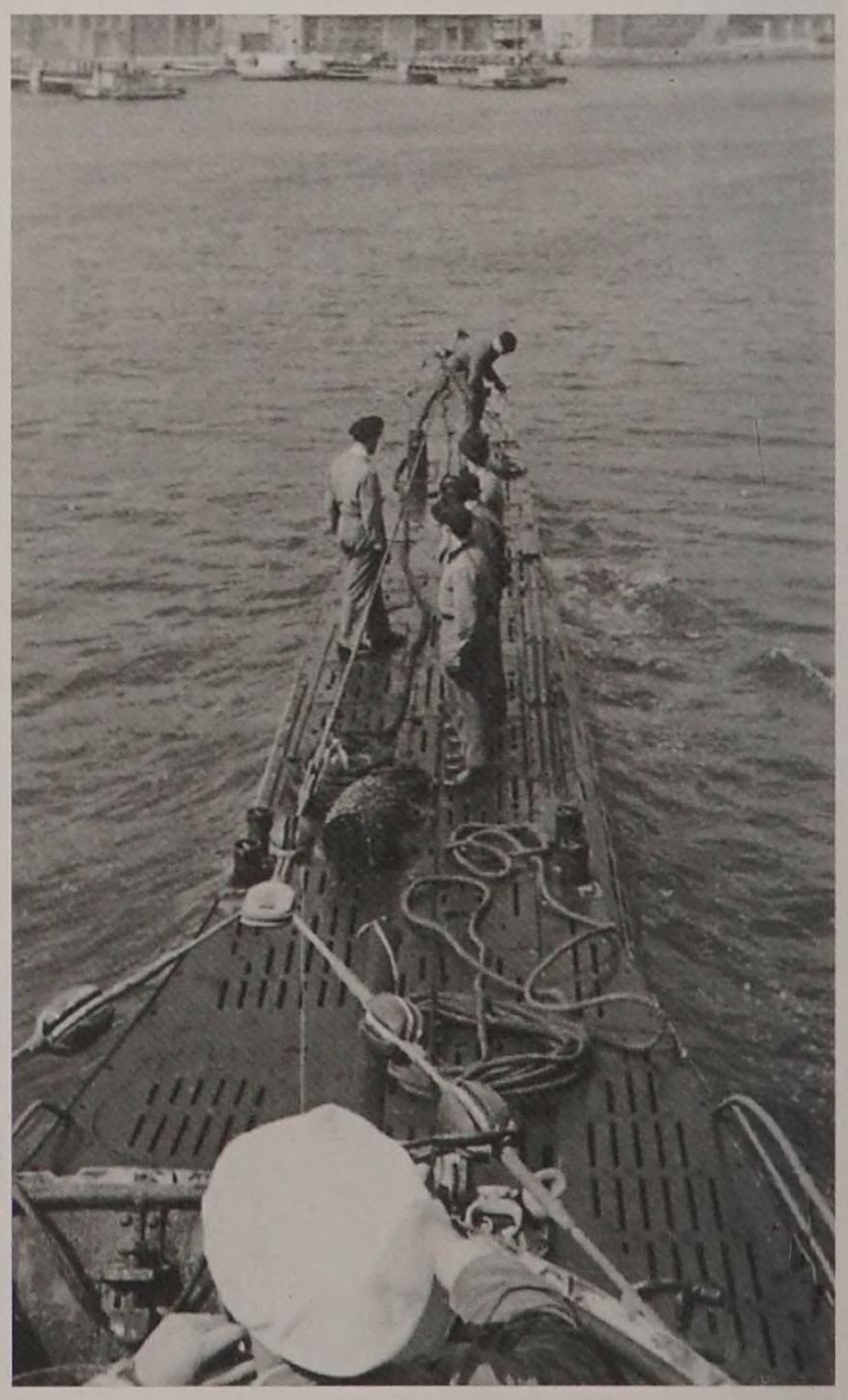
Type VII class boats, however, were not regarded as 'real' submarines capable of extended underwater operations. They could only remain submerged for limited periods and had to return to the surface regularly, making them vulnerable to surface attacks from the air. Later improvements included the addition of a *Schnorchel* (snorkel), which allowed Type VII boats to remain submerged for longer periods using electric motors for propulsion, while diesel engines recharged underwater (see pages 24–25).

A major drawback facing Type VII boats was the small amount of fuel storage available for its intended role as an attack boat on longer



LEFT Type VII class submarines nearing completion at the Friedrich Krupp Germaniawerft factory in Kiel. *(Karl Parlour)*

BELOW A Type VII class boat prepares to drop anchor in dock after a short patrol. *(Through Their Eyes)*

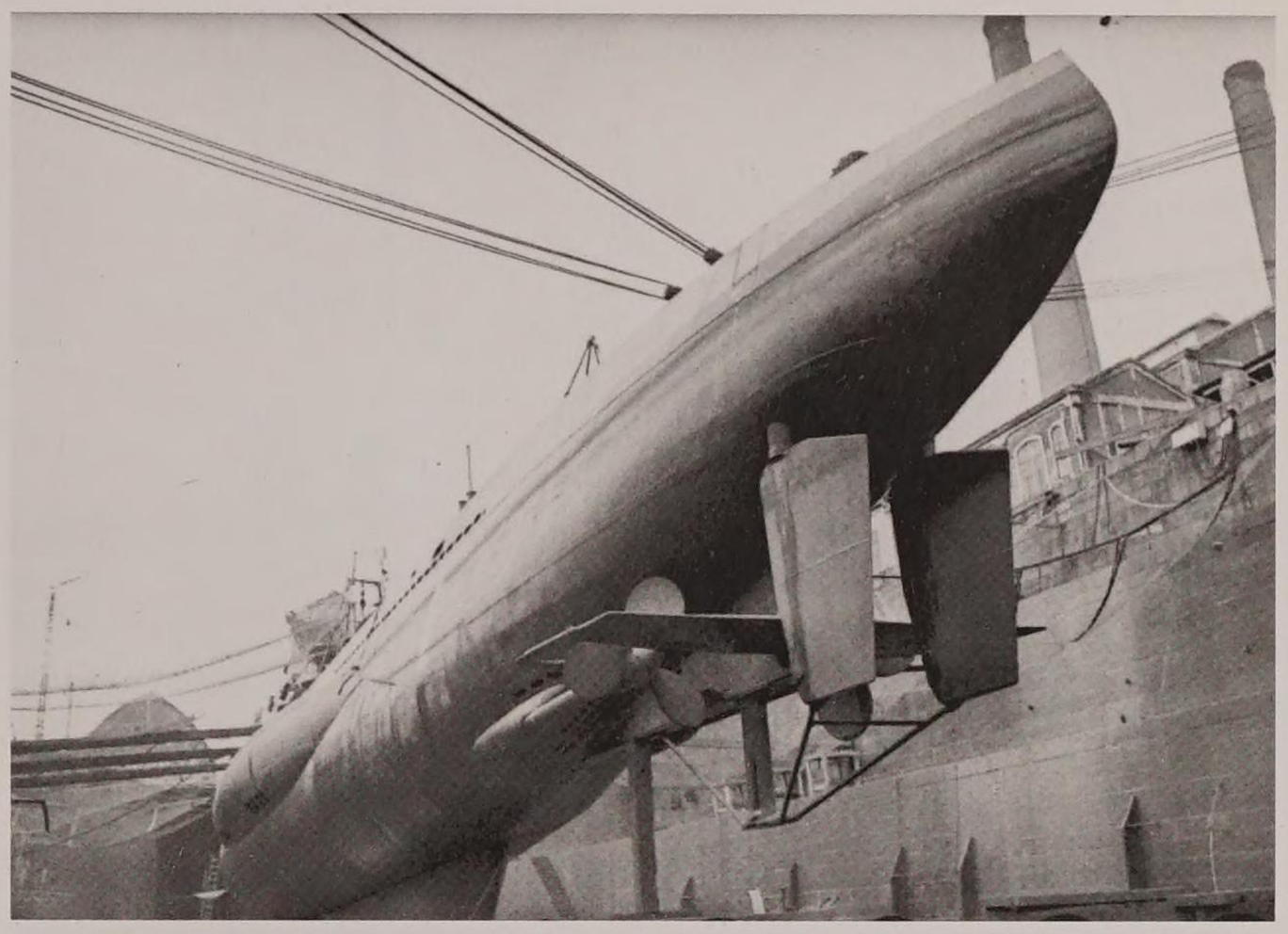


patrols. Later modified versions carried an additional 33 tons of fuel in external saddle tanks, giving the boat an extra 2,500nm range. These improved boats were considerably more powerful, agile and faster than original Type VIIA boats, with the addition of submerged twin rudders, propellers and hydroplanes instead of the single ones fitted to original designs.

Further information about Type VII variations from A through to F can be found in later chapters.

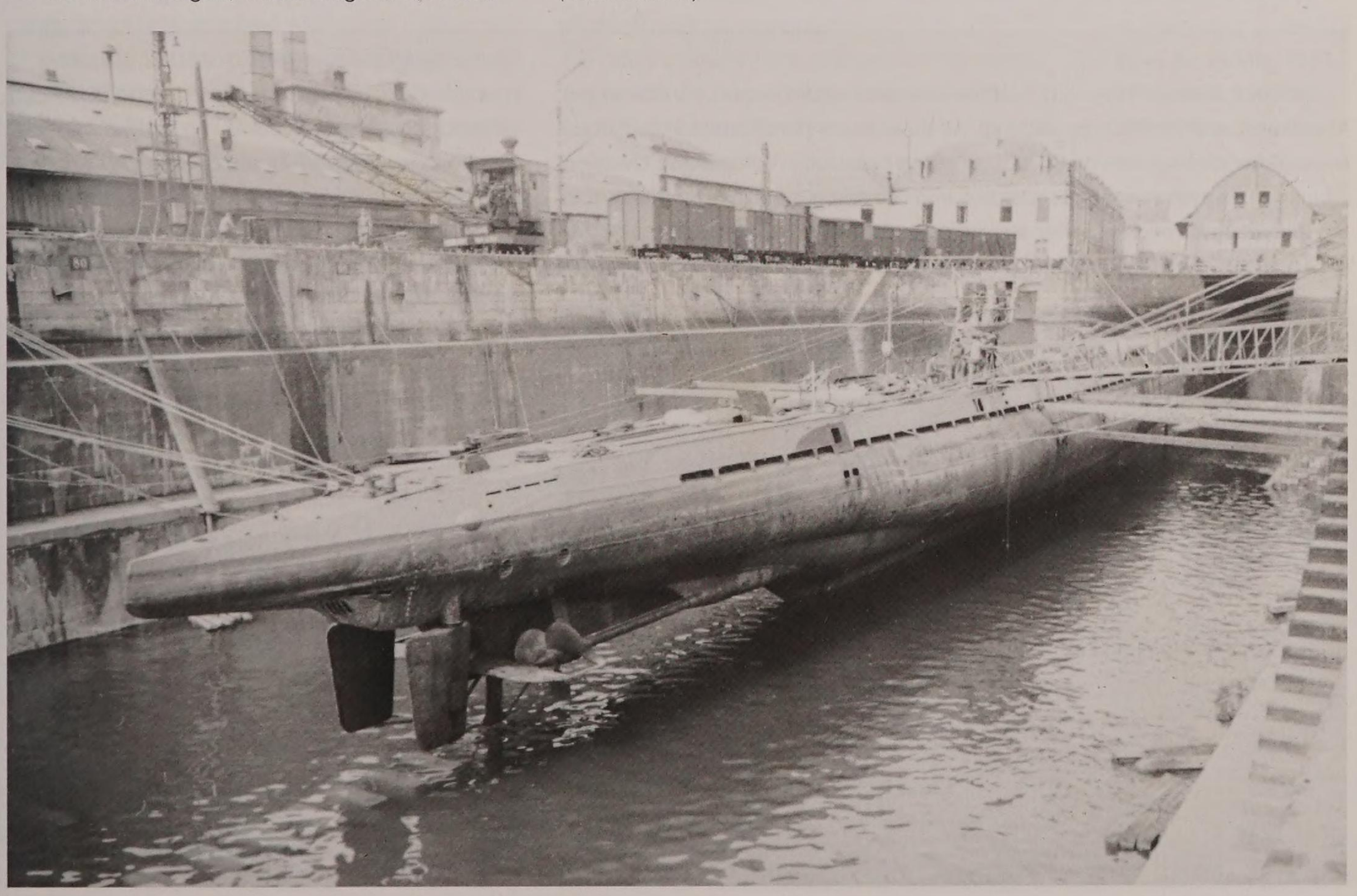
Type IX U-boats were designed in 1935/36 as long-range ocean-going submarines for use on lengthy operations far from home support facilities. The first in the series of seven varieties built from 1936 to 1942 was the Type IXA, constructed by AG Weser in Bremen. Eight boats were constructed, ranging from U-37 through to U-44. U-37 was launched on 4 May 1938, equipped with three periscopes – two in the conning tower and one in the control room.

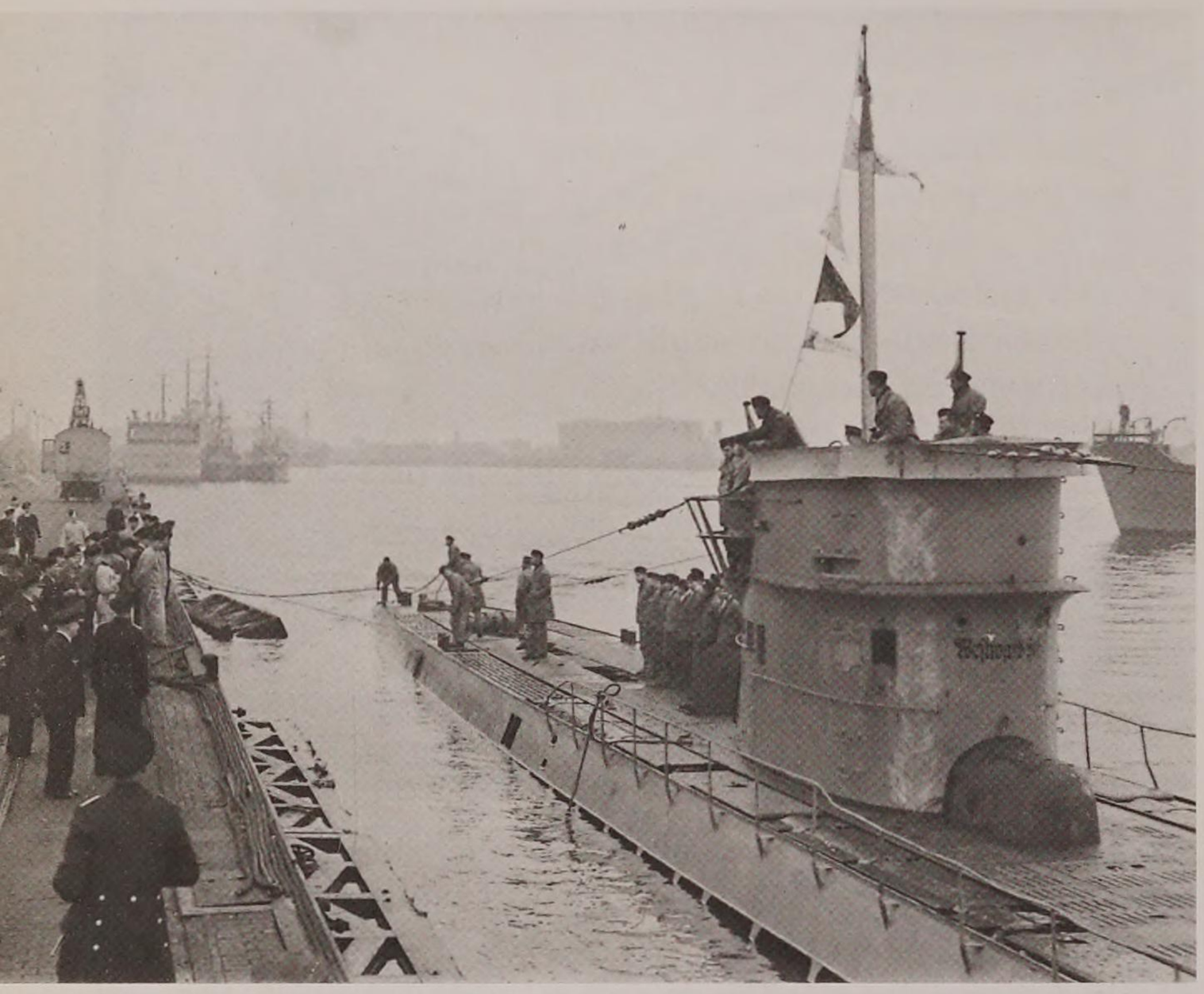
With its 76.6m length, Type IXA boats were sleek, elongated and streamlined. They could travel at speeds of up to 182 knots surfaced and 7.7 knots submerged, with a range of 8,100nm



ABOVE Type IX U-37 showing her twin rudders, stern hydroplanes and propellers. *(Bundesarchiv)*

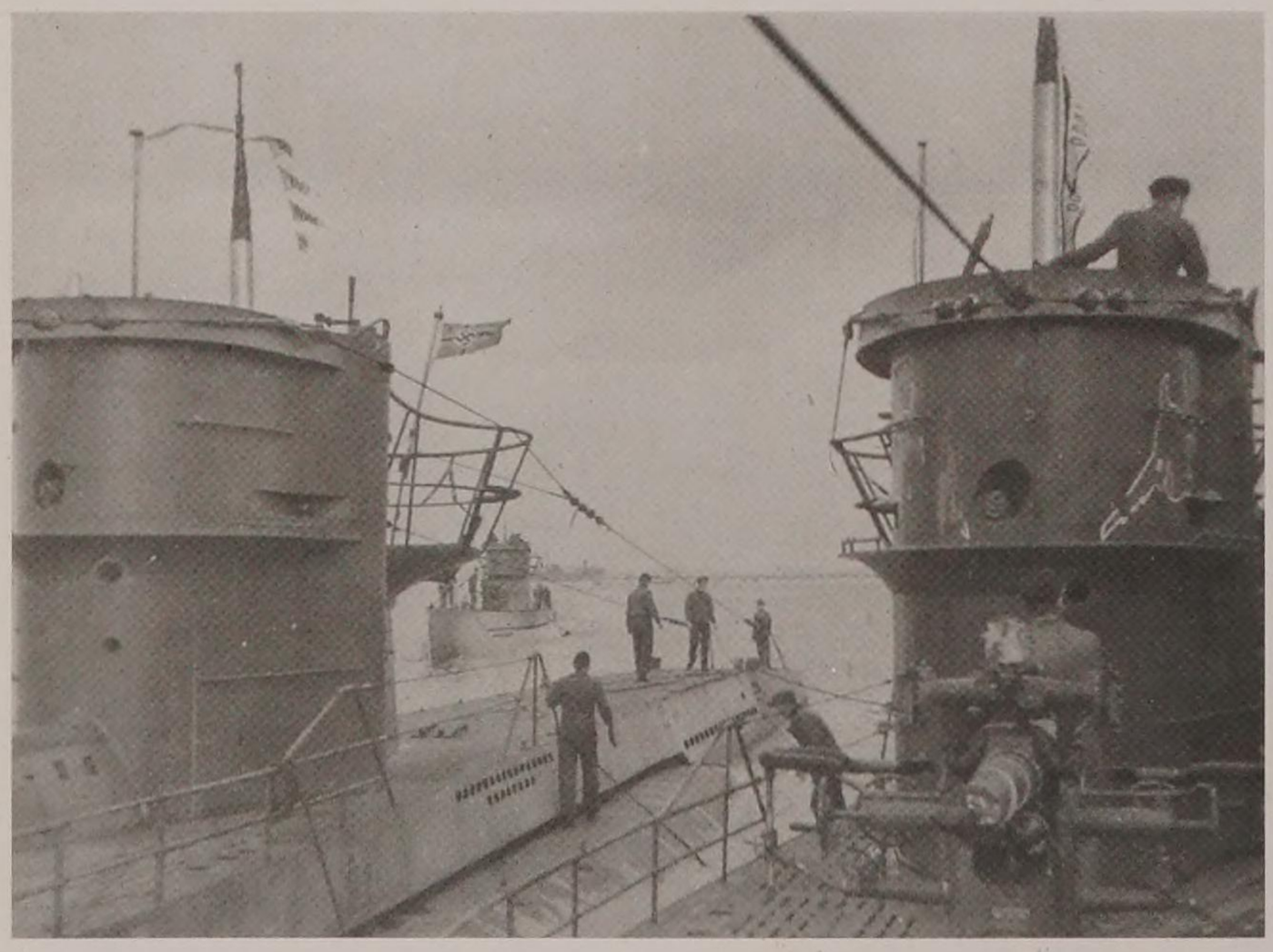
BELOW A general view of U-37 in dry dock at Lorient during 1940. Her main ballast tanks, propeller shafts, rudders and skeg can be clearly seen. Launched in 1938, she survived 11 war patrols and sank over 200,000 tons of Allied shipping before she was scuttled by her crew on 8 May 1945. *(Bundesarchiv)*





ABOVE The Type IX U-boat (Type IX/D2 U182 is pictured) was originally produced in 1935–36 as a large ocean-going submarine for sustained operations far from home support facilities. It was the most successful version of the Type IX class series with each boat averaging thousands of tonnes sunk. *(Bundesarchiv)*

BELOW A trio of Type VIIC 'wolfpack' raiders return to port – U-604 (right), U-659 (left) and U-409 (approaching). All three boats participated in the attack of the 24-ship convoy SL-125 travelling between Freetown and Liverpool carrying passengers, foodstuffs, iron ore and pig iron, frozen meat, rice, copper, palm oil and tea. After sinking 12 of the ships and damaging a further 2, the convoy returned to the French port of Brest in company. *(Karl Parlour)*



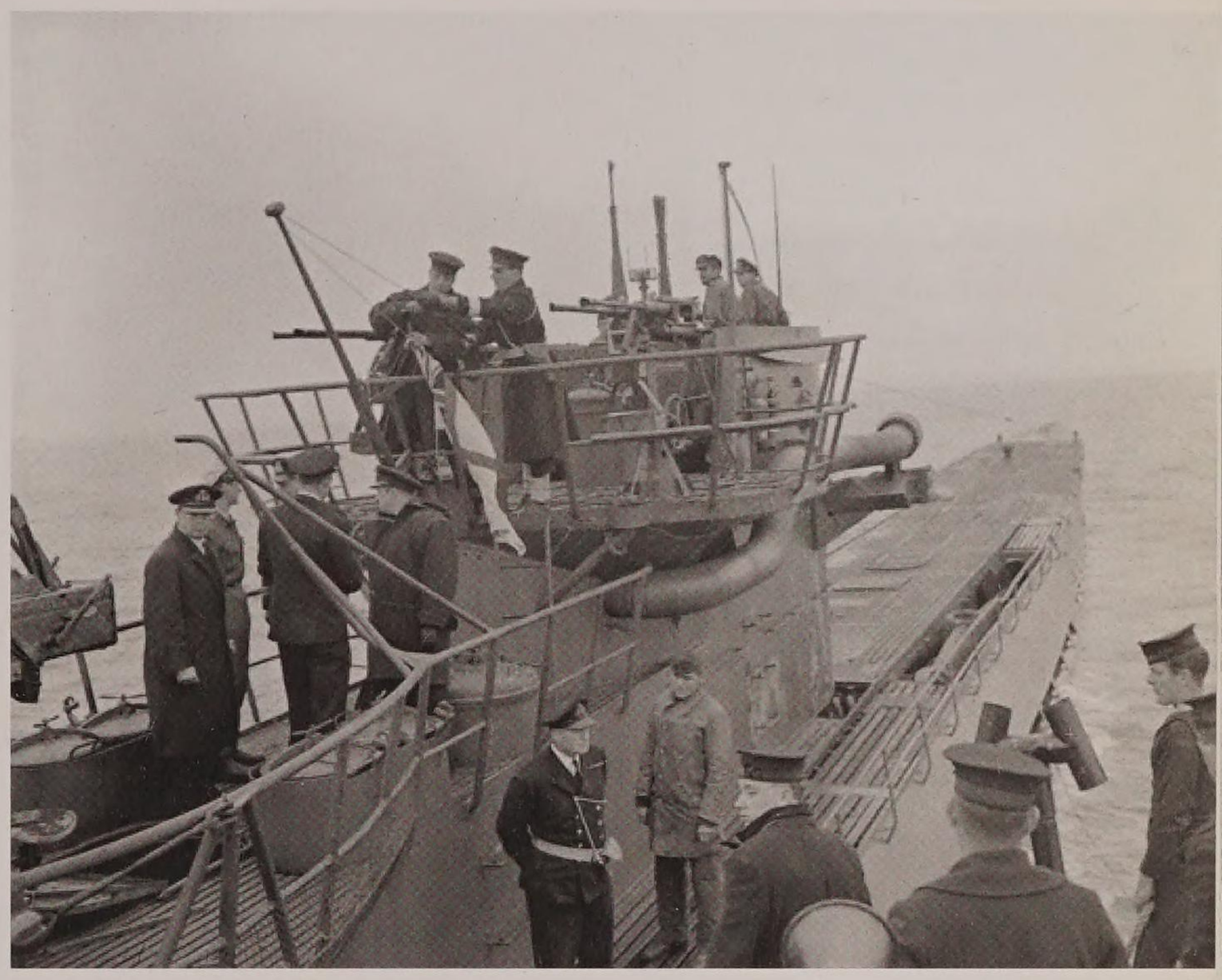
surfaced and 65nm submerged. This allowed the boats to cross the Atlantic to reach the eastern seaboard of the United States and disrupt the stream of troops and supply ships crossing to Europe. But the extended range came at the cost of longer dive times which decreased manoeuvrability and this was the main reason why smaller and more manoeuvrable Type VIIs were produced in such numbers and used for the bulk of Atlantic operations.

The Type IX class series comprised 195 vessels ranging from IXA through to XID. Each was fitted with six torpedo tubes – four at the bow and two at the stern. They carried six reloads internally and also had five external torpedo containers (three at the stern, two at the bow) which stored ten additional torpedoes. With 22 torpedoes available, Type IX commanders could hunt and stalk convoys and spring surprise night attacks. As mine-layers they could carry 44 TMAs (moored mines secured by an attached heavy anchor and a cable) or 66 TMB mines (a mine settled at the seabed and detonated by the magnetic or acoustic signature of a passing ship). Secondary armament was provided by single Utof 105/45 deck guns with 110 ammunition rounds. Anti-aircraft armament on the IX class differed throughout the war in a similar way to weapons on Type VII boats.

Fourteen IXB class boats were produced, ranging from U-64 and U-65, U-103–U-111 through to U-122–U-124. They were improved versions of the IXA class with an increased range from 8,100nm (surfaced) and 65nm (submerged) to 8,700nm (surfaced) to a slightly slower 64nm (submerged). Type IXB boats were considered the most successful overall version of the class, with each boat averaging over 100,000 tons sunk.

IXB boats worthy of note included U-123, which in January 1942 became one of the most famous German wartime submarines after taking part in the opening of the *Paukenschlag* operations (Operation Drumbeat), the informal name for the period during which U-boats attacked merchant shipping along the east coast of the United States. The boat completed two successful patrols, hunting and attacking merchant shipping and participating in six wolfpack operations between October

RIGHT U-889 is seen here surrendering to motor launch Q117 of the Royal Canadian Navy off Shelburne, Nova Scotia, 13 May 1945. *(Canadian National Library and Archive)*



1941 and March 1943. U-107, operating off Freetown, Sierra Leone, recorded the most successful single mission of the war sinking 14 merchant vessels amounting to 87,000grt (gross registered tonnage).

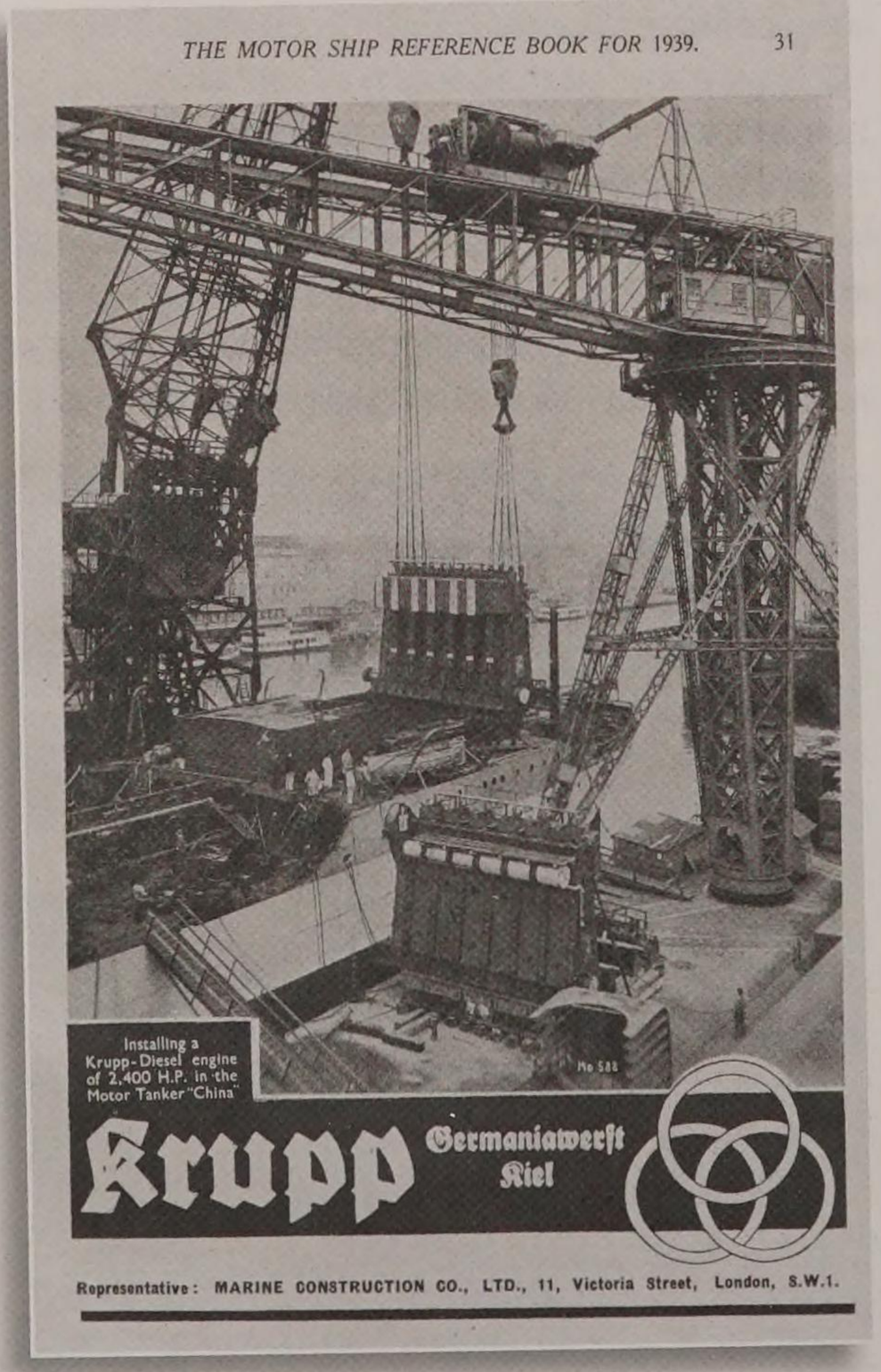
Fifty-four long-range IXC class boats were built as another development, which included storage space for an additional 43 tons of fuel to provide increased range up to 13,400nm. The series reverted to the two-periscope system, both of which were located within the conning tower. As minelayers they could carry 44 TMA or 66 TMB mines, although 35 later models – U-162–U-170 and U-505–U-550 – were not fitted for mine operations. An additional 87 Type IXC/40 vessels were built by AG Weser and Seebeckwerft of Bremen and Deutsche Werft of Hamburg as improved versions of the IXC with a slightly increased range and surface speed.

Type IXC U-boat U-505 still survives and has been completely renovated at its home at Chicago's Museum of Science and Industry where it has been on public display since 1954. The boat was captured in June 1944 by US Navy Task Group 22.3. The boat's codebooks and other secret charts assisted Allied code-breaking operations. All but one of the submarine's crew was rescued. The boat was secretly towed to Bermuda and its crew interned at a US prison camp where they were denied International Red Cross visits. The US Navy classified the capture as top secret to prevent its discovery and its whereabouts becoming known to Germany.

U-505 was one of six U-boats captured during the Second World War and was the first vessel to be seized by US forces on the high seas since the 1812 Anglo-American War of

BELOW After surrendering to the US Navy on 15 May 1945, U-805 flies the Stars and Stripes from her bridge as she prepares to dock at Portsmouth, New Hampshire. *(Library of Congress)*

ABOVE Today, Type IXC U-534 is a much visited tourist attraction on Merseyside. *(Merseytravel)*


THE MOTOR SHIP REFERENCE BOOK FOR 1939. 31
Installing a Krupp-Diesel engine of 2,400 H.P. in the Motor Tanker "China"
Krupp
Germaniawerft
Kiel
Representative: MARINE CONSTRUCTION CO., LTD., 11, Victoria Street, London, S.W.1.

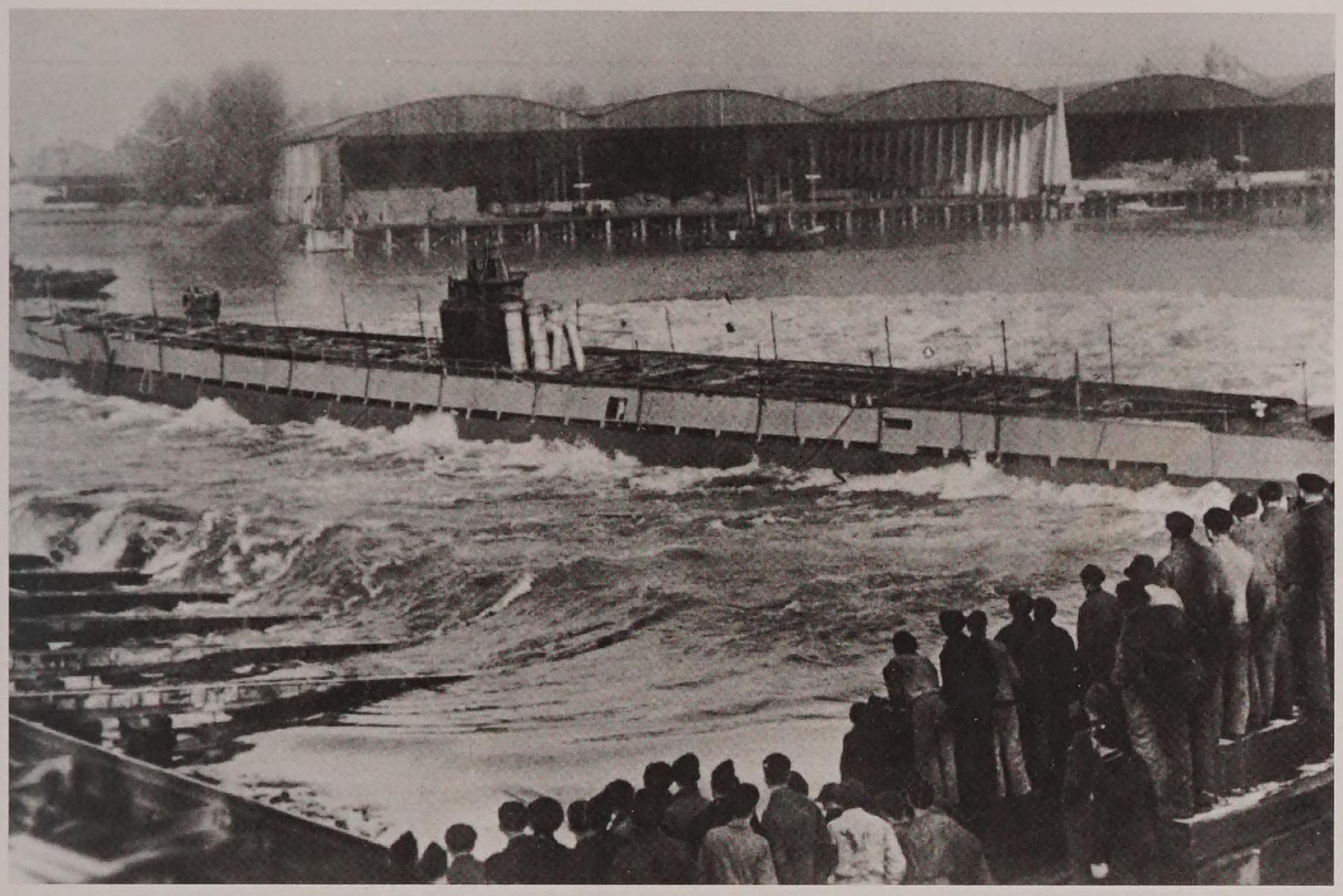
RIGHT Friedrich Krupp Germaniawerft, which produced 240 U-boats for the Kriegsmarine, maintained a London office between the wars through an agreement with the Marine Construction Company Ltd. The agreement was terminated at the outbreak of war in 1939.

Independence. Within the Kriegsmarine, U-505 became known as the most heavily damaged U-boat to successfully return to port during the war (following her fourth patrol). She was also the only U-boat in which a commanding officer – *Kapitänleutnant* Peter Zschech – took his own life in combat conditions (on her tenth patrol) following six unsuccessful sorties. He had been suffering from a severe mental breakdown.

Another IXC class U-boat – U-534 – is now on display at Birkenhead's Woodside Ferry Terminal. Originally used for training duties, the submarine sank no enemy ships. An RAF Liberator aircraft sank her in May 1945 in the Kattegat, a shallow sea area 20km north-east of the Danish island of Anholt. She was carrying a crew of 52 men, all of whom escaped although only 49 survived. U-534 lay on the seabed for over 40 years until she was discovered in 1986 by Danish salvage diver Aage Jensen, amid rumours that the U-boat was attempting to get away with Nazi gold. No gold was found, although hundreds of items and possessions once owned by crew members were brought to the surface when the submarine was salvaged in 1993. In May 1996 it was moved to the Historic Warship Museum in Birkenhead and later acquired by Merseytravel – Merseyside's public transport network – who cut it into sections using art diamond wire and moved it to the Woodside Ferry Terminal as the centrepiece for the U-boat Story exhibition.

U-boat Type X was designed to carry newly developed Schachtmine A (SMA) moored mines. The original design provided dry storage accommodation for mines needing detonators to be individually adjusted before each launch. It was projected to have displaced up to 2,500 tons. A variant, Type XA, was planned to supplement the main mine chamber with extra mine shafts located in the saddle tanks. Neither type entered production.

Eight Type XB boats were produced, replacing the mine chamber of the projected Type XA with six vertical wet storage shafts in the forward section of the hull. Up to 18 mines could be carried in these shafts, with an additional 48 mines in a series of 12 other shafts set into saddle tanks on each side. The boat had only two torpedo tubes, both located at the stern. When used as cargo-carrying

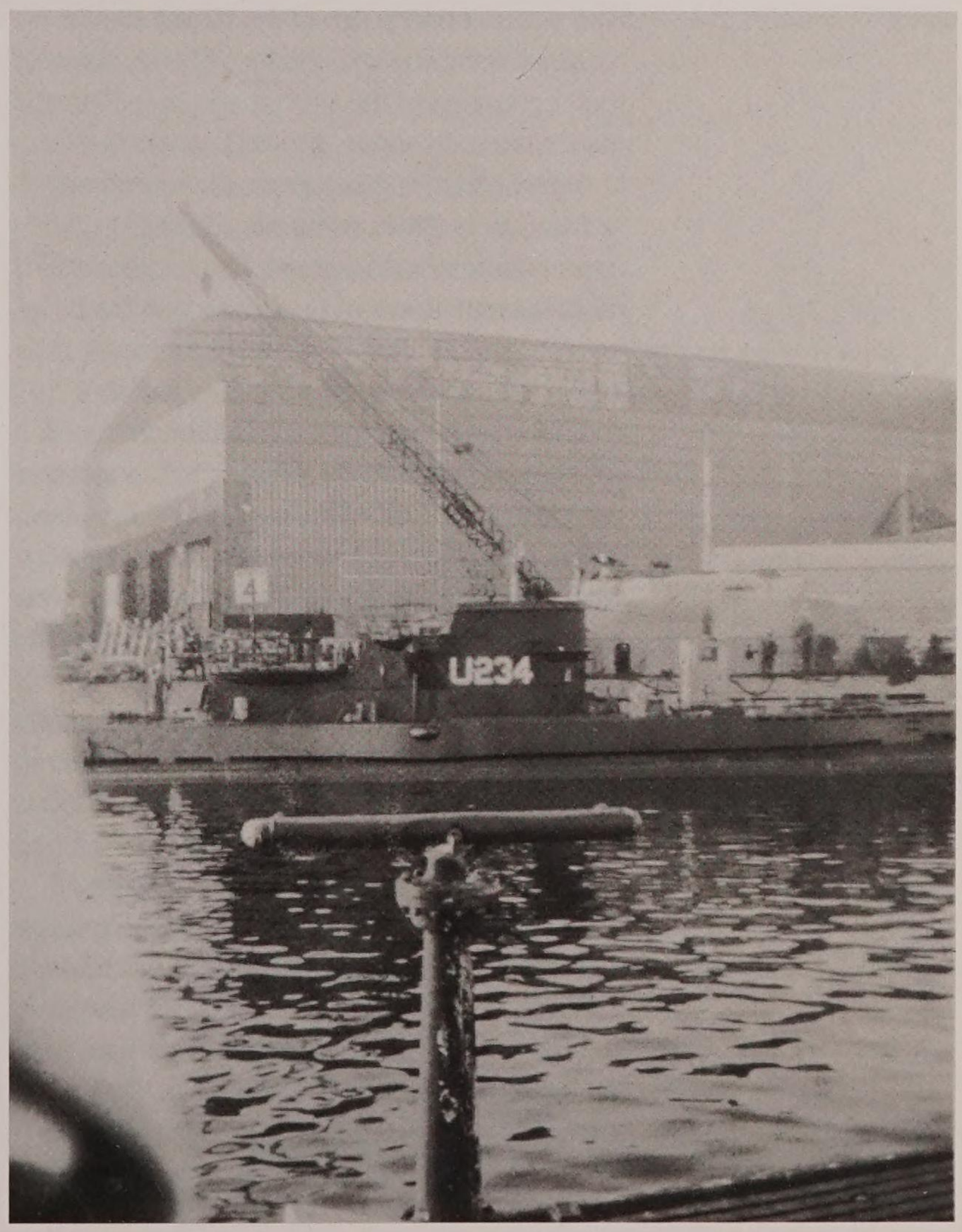


LEFT An 'official' German photograph syndicated to Allied newspapers in Europe and North America in May 1941. The caption reads: *'Another German sub takes to the water; workers line up along a pier to watch another German submarine slide sideways down the ways into the water at Stapel (Lower Saxony). Passed by the German censor.'* *(Acme Newspictures, Inc., New York)*

submarines they carried freight containers in the mine shafts.

The first Type XB was launched in May 1941. Built by Friedrich Krupp Germaniawerft at Kiel and designed to weigh in at 2,710 tons submerged and fully loaded, they were the largest German U-boats ever built. Their size, however, meant that they needed to sacrifice their overall diving speed and agility.

Six of the eight XB class boats built were destroyed during the war, but the remaining two survived. One was U-234. Towards the end of 1944 U-234's officers and crew were informed they were to make a secret voyage to Japan carrying 240 tons of cargo plus sufficient diesel fuel and provisions for a six- to nine-month voyage. The cargo manifest contained items for the 'Empire of Japan' including technical drawings, examples of the newest electronic torpedoes, 560kg of uranium oxide, a crate containing an unassembled Messerschmitt Me262 jet aircraft (the world's first operational jet-powered fighter aircraft) plus ten jet engines and a Henschel Hs 293 glide bomb (a radio-controlled bomb with a rocket engine slung beneath it).



LEFT This Type XB U-boat was on a secret mission to Japan when it was ordered to surrender to the US Navy. *(US Navy photograph)*

U-234 sailed from Kiel on 25 March 1945 under the command of Kapitänleutnant Johann-Heinrich Fehler. On 4 May Fehler picked up fragments of a broadcast from British and American radio stations announcing Hitler's death and that Dönitz had been appointed Germany's new head of state. Over the radio the crews heard Dönitz's last orders to his U-boat men, ordering them to surface, hoist black flags and surrender to Allied forces. At this point U-234 was equidistant from British, Canadian and American ports and Fehler decided not to continue his journey, heading instead for the east coast of the United States to surrender.

On learning that the U-boat was to surrender, the Japanese passengers committed suicide by taking an overdose of Luminal (a barbiturate sleeping pill). They were buried at sea. The US authorities dispatched two destroyers to intercept U-234 and on 14 May 1945 she was encountered south of the Grand Banks, Newfoundland, by USS *Sutton*. The ship's crew took command of the U-boat and sailed her to the Portsmouth Naval Shipyard, where U-805, U-873 and U-1228 had already surrendered.

News of U-234's surrender with her high-ranking German passengers was a major US news event. Reporters descended on the naval yard and were taken to sea to get a closer look at a real Nazi submarine. The fact that she had half a ton of uranium oxide on board was covered up and remained classified for the duration of the Cold War.

Another Type XB to survive was U-219, which reached Jakarta in December 1944 with a cargo of dismantled V-2 rockets for Japan. Following Germany's surrender, U-219 was seized by the Japanese at Batavia on 8 May 1945 and on 15 July 1945 was placed into the service of the Imperial Japanese Navy as I-505.

Type XI boats were planned in 1937 as artillery boats fitted with four 127mm guns mounted on to twin gun turrets. The boat was also designed to carry a lightweight Arado Ar 231 collapsible floatplane. Four boats (U-112, U-113, U-114 and U-115) were laid down in 1939 but cancelled in September 1939 following the outbreak of the Second World War.

Had the Type XI U-boat been completed, it would have had a new hull design and a submerged displacement of 4,650 tons. The XI class would have been by far the largest of the Kriegsmarine's U-boats and the second largest diesel submarine after Japan's I-400 class.

The 3,000-ton **Type XIV** tanker U-boat was a modified version of the Type IXD, designed to resupply other U-boats patrolling areas too far from home bases to keep returning to restock torpedoes and food. They were known to U-boat crews as *Milchkühe* (milk cows) due to their large size (67.1m long and displacing 1,688 tons). XIV class boats were equipped to resupply other boats with over 400 tons of fuel, torpedoes and fresh food preserved in refrigeration units. Boats were also fitted with bakeries to provide the luxury of fresh bread for crews. The boats carried no torpedoes or deck guns and only three anti-aircraft guns. They also carried one of the largest complements of crew of the entire U-boat fleet – 6 officers and 47 enlisted men.

Ten U-boats of this class were commissioned and put into active service from 1942 to 1944 – U-459 through to U-464 and U-487 through to U-490. Eight were sunk and two were scuttled.

One 'milk cow' could keep a dozen U-boats at sea for weeks. Refuelled, reprovisioned and rearmed with fresh supplies of torpedoes, they allowed U-boats to continue pressing their assault against merchant ships with reinvigorated enthusiasm. In 1942, 'milk cows' allowed smaller Type VIIC boats to raid American coastal shipping during the Battle of the Atlantic. The supply boats became primary targets for Allied forces, as sinking one 'milk cow' effectively curtailed operations of several regular U-boats, forcing them to turn around for home bases to get their supplies. Improved Allied radar and air coverage in the North Atlantic eliminated most XIV class boats by 1943. By the end of the war, all ten 'milk cows' had been destroyed by enemy attack or scuttled after the war. 'Milk cow' duty was particularly hazardous and nearly 300 U-boat crewmen were killed out of a complement of up to nearly 600 men serving on the boats.

Hellmuth Walter was a Hamburg-born engineer, entrepreneur and Nazi sympathiser who pioneered research into rocket engines and gas turbines. After working at the

Submarinos alemãos encontram - se no alto mar

LEFT A wartime postcard showing a rare sight – two U-boats passing each other in close proximity somewhere in the North Atlantic.

Germaniawerft shipyard in Kiel, Walter branched out on his own and in 1934 formed his own company, Hellmuth Walter Kommanditgesellschaft (known as Walter-Werke), to further research and develop his ideas. Eleven years before Walter had designed and patented a small, streamlined high-speed submarine propelled by high test peroxide. Walter reckoned that a submarine engine powered by a fuel source already rich in oxygen would not require external supplies from the atmosphere or from tanks. This would have obvious advantages for powering submarines and torpedoes.

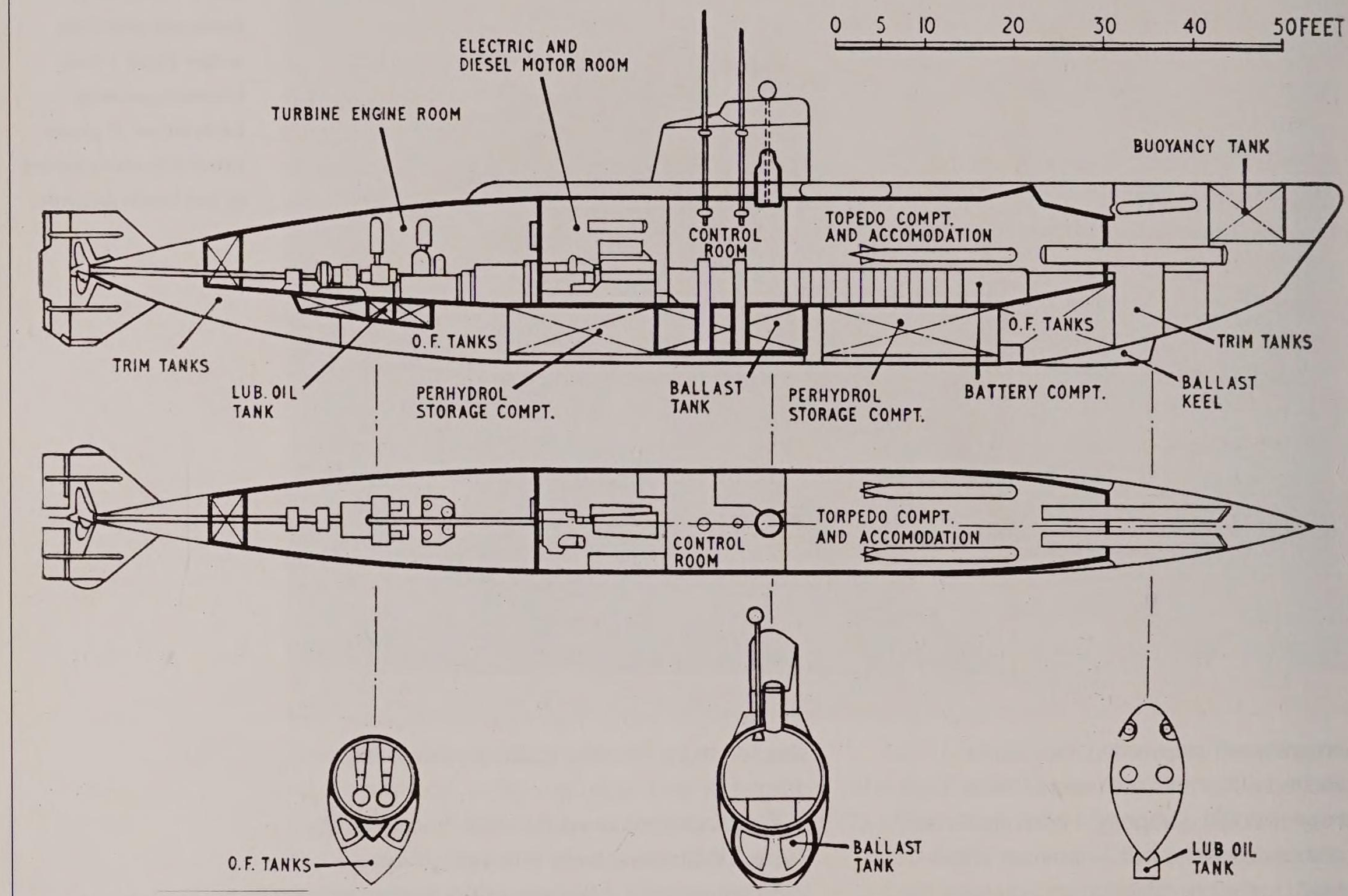
In 1940 Walter-Werke was awarded a contract to build an 80-ton prototype known as the **V-80**, which achieved underwater speeds of 28.1 knots during trials – making it twice as fast as any other submarine in the world at that time.

Despite spectacular results, problems with production, supply and safe handling of hydrogen peroxide prevented wide-scale implementation of Walter's revolutionary submarine. Crews found the boat difficult to handle at high speed and it was plagued by numerous mechanical problems, low efficiency and the fact that a significant amount of power was lost due to increased back pressure on the exhaust at depth. The length-to-beam ratio was also too high, resulting in unnecessarily high drag.

Only four coastal submarines, known as the **Type XVIIA** class, were built using Walter's V-80 engines. To members of the Kriegsmarine, the vessels were known as 'Walter Boats' as a tribute to their inventor. None was ever used in active combat. Their designated numbers were U-792 through to U-795.

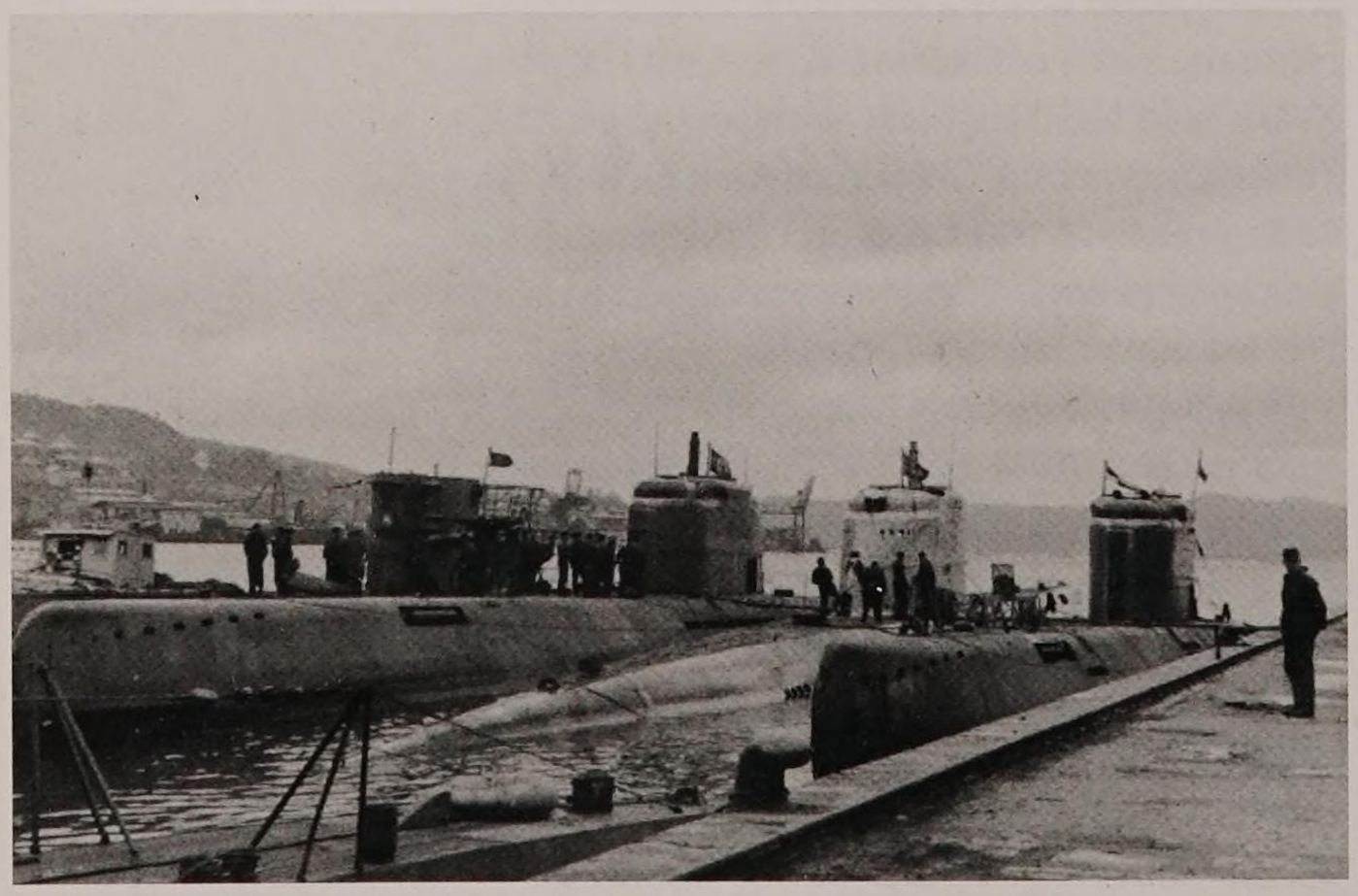
Despite the setback, Dönitz argued the case for further developing Walter's Type XVII class and on 4 January 1943 the Kriegsmarine ordered 24 Type XVII submarines, starting with an operational **Type XVIIB** to be built at the Hamburg yards of Blohm & Voss. Unlike the XVIIA, Type XVIIB had only a single turbine. The initial order was for 12 submarines – U-1405 through to U-1416 – but Blohm & Voss were struggling to cope with orders for Type XII boats and the order was reduced to six.

The Type XVIIB class weighed 312 tons surfaced and 337 tons submerged. The boat was 41.45m long and powered by one Deutz SAA SM517 supercharged 8-cylinder 210hp diesel engine and one 77hp AEG Maschine AWT98 electric motor. The boat could travel at speeds up to 8.8 knots surfaced and 5 knots submerged over 3,000nm with a crew of 19 officers and ratings. The boat was equipped



ABOVE Walter Boats – schematic.

BELOW Three Type XXI *Elektroboots* in Bergen, Norway, in 1945. In the centre is U-2511, one of the few Type XXI class boats to ever conduct a war patrol. On the evening of 30 April 1945 – the date of Hitler's death – U-2511 set out from Bergen for the Caribbean, but on 4 May she received the 'end-of-war' ceasefire order from Admiral Dönitz and surrendered.



with four torpedoes fired from two 533mm bow torpedo tubes.

Two Type XVIIB boats were completed by Blohm & Voss between 1943 and 1944 – U-1405 and U-1406. U-1407 and U-1405 were completed in December 1944, U-1406 in February 1945. Three further boats – U-1408 through to U-1410 – were under construction, but incomplete when the war ended. Another six Type XVIIBs – U-1411 through to U-1416 – were cancelled during the war in favour of Type XXI models.

The **Type XVIII** U-boat was an experimental attack boat, designed with the intention to use Walter's propulsion system. Two boats – U-796 and U-797 – were laid down in 1943, but construction was cancelled in March 1944.

Type XXI U-boats – known as '*Elektroboote*' (or electric boats) – were the first submarines designed to perform primarily submerged instead of as surface boats which could also dive. This new advanced class of boat could

crash-dive as a fast way of escaping enemy detection or to launch surprise attacks on Allied shipping.

No fewer than 118 boats were assembled by Blohm & Voss of Hamburg, AG Weser of Bremen and F. Schichau of Danzig between 1943 and 1945. The hull of each vessel was constructed from eight prefabricated sections. The Kriegsmarine expected this new method of submarine construction to take less than six months per vessel. However, all assembled U-boats were plagued with quality problems requiring extensive post-production work to correct the faults. Out of the 118 Type XXIs completed, only four were passed fit for use before the war ended in Europe.

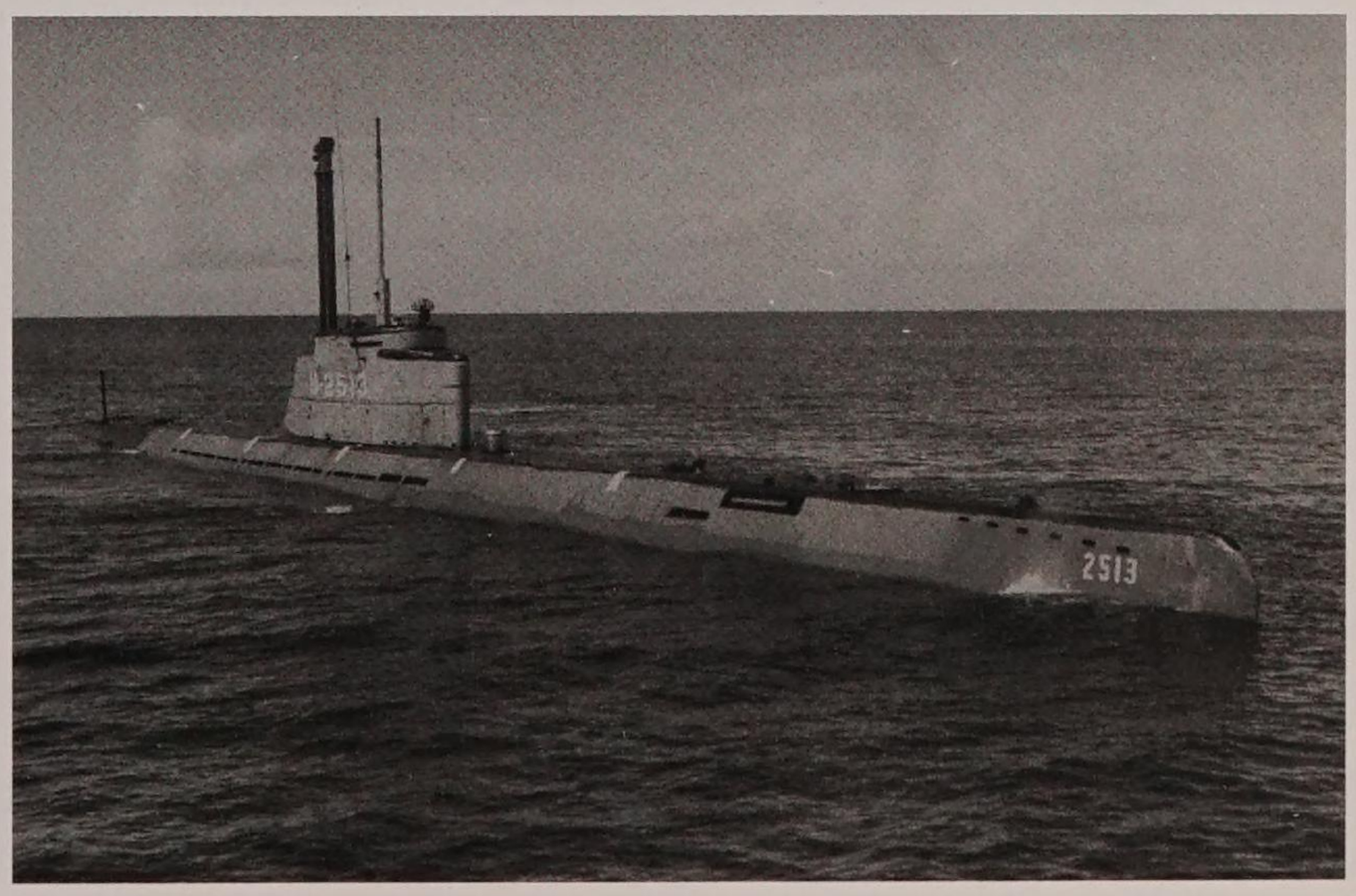
Final assembly of the XXI boats was scheduled to take place at the massive bomb-proof concrete bunker submarine pens on the River Weser at Farge, near Bremen. Code named 'Valentin', bunker construction was carried out using up to 12,000 French, Greek, Polish and Russian concentration camp prisoners and prisoners of war as forced labour. The facility was almost finished when it was damaged by Allied bombers in March 1945 using 'Grand Slam' earthquake bombs. It was then abandoned. Shortly afterwards the area fell into the hands of the British Army's XXX Corps and final assembly of the Type XXI boats took place at other shipyards. By this time, however, flaws were discovered in some of the prefabricated sections requiring lengthy reworking and causing construction programmes to slow down.

Increased battery capacity – triple that of the Type VIIC – gave the boats improved underwater range and reduced the time they spent on the surface or at periscope depth. They could travel submerged at about 5 knots for up to three days before needing to recharge batteries, a process which took under five hours using a snorkel. Type XXI boats were also quieter than the VIICs, making them harder to detect when submerged.

The XXI class carried a crew of five officers and 52 enlisted men. They displaced 1,621 tons surfaced and 2,100 tons submerged and were 76.7m long with a beam of 8m and a draught of 5.3m. They were powered by two diesel/electric MAN M6V40/46KBB supercharged 6-cylinder diesel engines, two SSW GU365/30 double acting electric motors, 5,000PS and two SSW GV232/28 silent-running electric motors. The engines allowed the U-boat to travel at surface speeds of up to 15.6 knots (diesel) or 17.9 knots (electric) and when submerged 17.2 knots (electric) and 6.1 knots using the silent-running motors. XXI class boats had a range of 15,500nm surfaced and 340nm silent running. In addition to six bow torpedo tubes and twenty-three torpedoes, the boat carried four 20mm cannon.

The Type XXI's streamlined and hydrodynamically clean hull design allowed boats to crash-dive with greater speed. The ability to outrun many surface ships while submerged, thanks to its new hull form, made it harder to be pursued or destroyed by surface vessels. The new hull also gave the boat 'sprint ability' when positioning itself for attack. Older boats had to surface to sprint into position, sometimes revealing their location to aircraft working with convoy escorts. The improved hull design also reduced visibility to marine or airborne radar when surfaced. The XII class also featured a hydraulic torpedo reloading system allowing all six bow torpedo tubes to be reloaded faster than a Type VIIC could reload a single tube. The boats could fire 18 torpedoes in less than 20 minutes. Type XXIs also had better and more comfortable crew facilities than previous U-boat classes, and included freezers for food.

U-2511 and U-3008 were the only Type XXIs to go on war patrols and neither sank



BELOW Type XXI boat U-2513 was used by the US Navy for several years after the war. It was commanded by U-boat ace *Fregattenkapitän* Erich Topp in the last weeks of the war.

any ships. In 1957 U-2540, which had been scuttled at the end of the war, was raised and refitted as research vessel *Wilhelm Bauer* for use by the German naval armed forces (Bundesmarine). She was operated by both military and civilian crews in a research role until 1982 and in 1984 was opened to the public by the Deutsches Schiffahrtsmuseum (German Maritime Museum) in Bremerhaven. U-2518 became the French submarine *Roland Morillot* and saw active service during the 1956 Suez Crisis. The boat remained in commission until 1967 and was scrapped in 1969.

Four Type XXI boats were assigned to the Soviet Union by the Potsdam Agreement – U-3515, U-2529, U-3035 and U-3041 – and

BELOW Type XXI U-2540's active life was brief: she was launched on 13 January 1945 and scuttled on 4 May. In 1957 she was raised and refurbished to become the research vessel *Wilhelm Bauer* in the Bundesmarine. She was transferred to the Deutsches Schiffahrtsmuseum (German Maritime Museum) at Bremerhaven in 1984 where she can be visited to this day.

commissioned into the Soviet Navy as B-27, B-28, B-29 and B-30 (later B-100) respectively. However, post-war Western intelligence believed the Soviets acquired several more Type XXI boats. A review by the US Joint Intelligence Committee for the Joint Chiefs of Staff in January 1948 estimated the Soviet Navy had 15 operational Type XXIs, could complete construction of a further 6 within two months and build a further 39 within a year – half of them from prefabricated sections and components seized from F. Schichau's Danzig yard and captured by the Red Army at the end of the war. U-3538 through to U-3557 remained unfinished in Danzig and were scrapped or sunk in 1947. Four boats assigned by Potsdam were used in trials and tests until 1955, then scuttled or used for weapon testing between 1958 and 1973.

U-3017 was commissioned into the Royal Navy as HMS N41 and used for tests until it was scrapped in November 1949.

Type XXI and XXIII U-boats revolutionised post-war submarine design and were in use in various formats up until 2011.

While Type XXI boats were the first '*Elektrobootes*' to go into operation, **Type XXIIIs** were the first in class to be created. Designed as small, agile coastal submarines operated by crews of 14–18 men, they were intended for operations in waters of the North Sea, Black Sea and Mediterranean, where larger Type XXI boats were at risk. They were transported to these locations by rail. The boats were small and carried just two torpedoes, which were loaded externally. Like larger Type XXI boats, they remained submerged for long periods and were faster than all previous designs thanks to improved streamlining of their shape, larger-capacity batteries and the snorkel, which allowed their diesel engines to be used while submerged.

When development began on Type XXI boats in late 1942, it was proposed to simultaneously develop a smaller version incorporating the same advanced technology to replace Type II boats. Development of the Type XXIII was given high priority, with an emphasis on using existing components wherever possible. To reduce development time, Hellmuth Walter designed the new boat based on the previous Type XXII prototype. By June 1943 designs were ready and construction began at shipyards in Germany, France, Italy and German-occupied Russia. The lead contractor was Deutsche Werft in Hamburg.

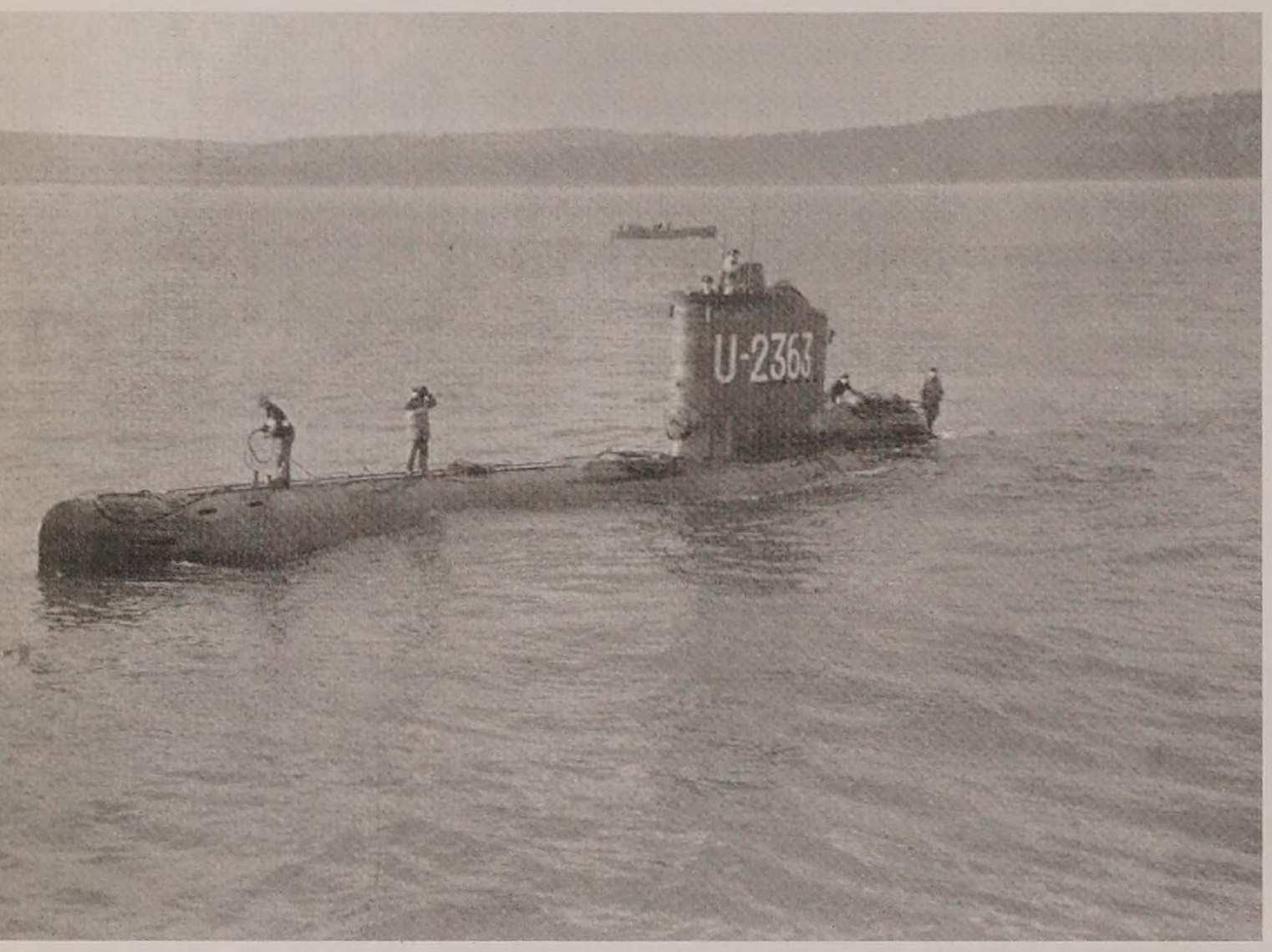
As with the Type XXI, Type XXIII class boats were intended to be constructed in sections with different modules manufactured by subcontractors. Some were to be assembled at foreign yards, including U-2446 through to U-2460 at Deutsche Werft's Black Sea yard at Mykolaiv in southern Ukraine. These were reassigned to the Linzner Werft yard in May 1944 and then subsequently cancelled. Construction was finally concentrated at Germaniawerft in Kiel and Deutsche Werft in Hamburg. Of the 280 submarines ordered, only 61 entered service and only 6 ever went out on war patrols.

The Type XXIII was the first submarine to be given an all-welded single-hull design. It had a fully streamlined outer casing and apart from the small conning tower and a fairing to house diesel exhaust silencers, it had an uncluttered upper deck. In line with Walter's usual design practice, there were no forward hydroplanes, although these were added later.

The submarine was propelled by a single three-bladed propeller and steered by a single rudder. As with the Type XXI, the lower section of the hull was used to house a large 62-cell battery.

To allow the boat to be transported by rail, sections of the hull had to be limited in size to fit the standard loading gauge. For transportation, the hull was broken into four sections and the bridge removed. Due to space restrictions, the forward bow section was made as short as possible, allowing only two torpedo tubes to be fitted and no reload torpedoes carried. Torpedoes were loaded by ballasting the submarine down at the stern so that the bow lifted clear of the water and torpedoes loaded directly into tubes from a barge.

The Type XXIII had excellent handling characteristics and was highly manoeuvrable on the surface and underwater. Crash-dive time was 9 seconds and its maximum diving depth was 180m. The submerged speed was 12.5 knots and surfaced speed 9 knots.



ABOVE Type XXIII U-boats were the first of the so-called *Elektroboots* to become operational. They were small coastal submarines designed to operate in the shallow waters of the North Sea, Black Sea and the Mediterranean. The Type XXIII was so small it carried only two torpedoes, which had to be loaded externally, but it was able to remain submerged almost all of the time. It was also fast thanks to the improved streamlining of its shape, with larger capacity batteries and the addition of a snorkel. No Type XXIIIs were sunk by Allied ships but they sank or damaged five enemy vessels for a total of 14,601 tons.

A submerged speed of 10.5 knots could be also achieved while snorkelling.

U-2321, the first Type XXIII, was launched from Deutsche Werft in Hamburg in April 1944. It was one of six XXIIIs that went out on operational patrols around the British coastline in 1945. Forty-eight others followed from Deutsche Werft and thirteen from Germaniawerft of Kiel. U-4712 was the last one launched, which took place on 19 April 1945. None of the six operational Type XXIIIs – U-2321, U-2322, U-2324, U-2326, U-2329 and U-2336 – were sunk by Allied ships, although the boats themselves sank or damaged five ships for a total of 14,601 tons.

One Type XXIII was allocated to the Soviet Union under the terms of the Potsdam Agreement, and a second unit was reportedly salvaged in 1948. In 1956 the German Federal Navy raised two Type XXIII boats – U-2365 (scuttled in the Kattegat in 1945) and U-2367 (which sank near Schleimünde following a collision with another U-boat) – and recommissioned them as U-Hai (Shark) and U-Hecht (Pike), with pennant numbers S170 and S171 respectively. U-Hai sank in a gale off Dogger Bank in September 1966, taking 19 of her 20 crewmen with her. Her loss became the greatest maritime disaster that the Bundesmarine and the Deutsche Marine had suffered in over 50 years of their existence. Experience gained from the two recommissioned submarines led to the construction of diesel-electric Type 206 submarines developed by Howaldtswerke-Deutsche Werft, which were still in use until 2011.

If advanced tactical submarines such as Types XXI and XXIII had been developed earlier in the war, it *just might* have changed the course of Germany's war at sea. But it proved to be too little and too late to make any difference. After the war the U-boat force was disbanded and defeated U-boat men returned to their homes.

But German submarine technology continued to develop through the post-war years. From 1955 onwards, the West German Bundesmarine was permitted to form a small navy initially using two sunken Type XXIIIs and a Type XXI raised from the seabed and repaired. By the 1960s, West Germany was back in the submarine manufacturing business. Because the country was at first restricted to a 450-ton displacement limit, the Bundesmarine focused on producing small coastal submarines used to protect Germany against Soviet threats in the Baltic Sea. Germany used highly advanced technologies to offset the small displacement, such as magnetic steel to protect against naval mines and magnetic anomaly detectors.

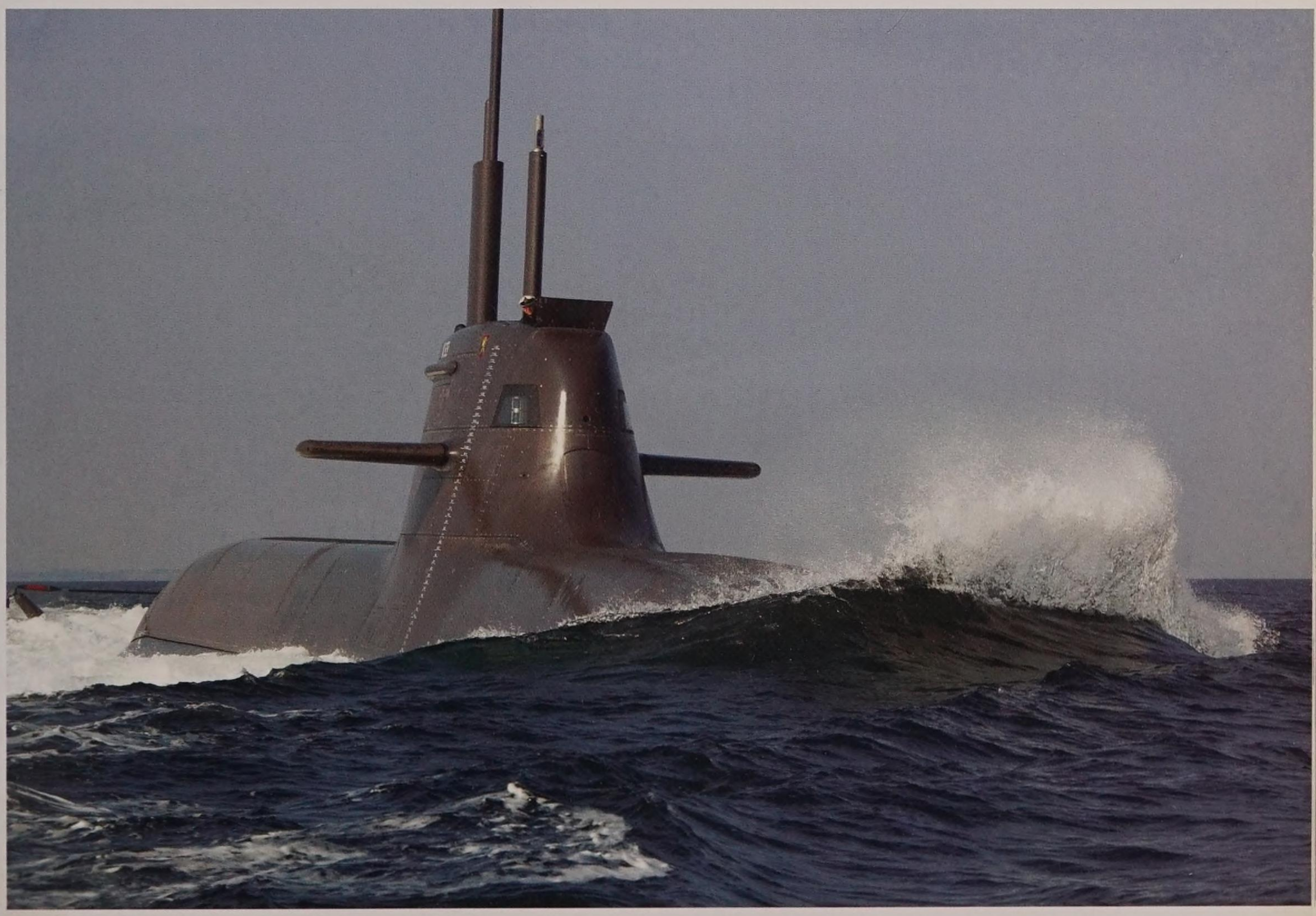
The submarines were built by ThyssenKrupp Marine Systems GmbH following a January 2003 merger between Blohm & Voss Naval GmbH and Howaldtswerke-Deutsche Werft GmbH. The **Type 205**, a single-hull diesel-electric boat first commissioned in 1967, was a success and 12 were built for the German Navy. To continue the U-boat tradition, new boats received the classic 'U' designation starting all over again with U1.

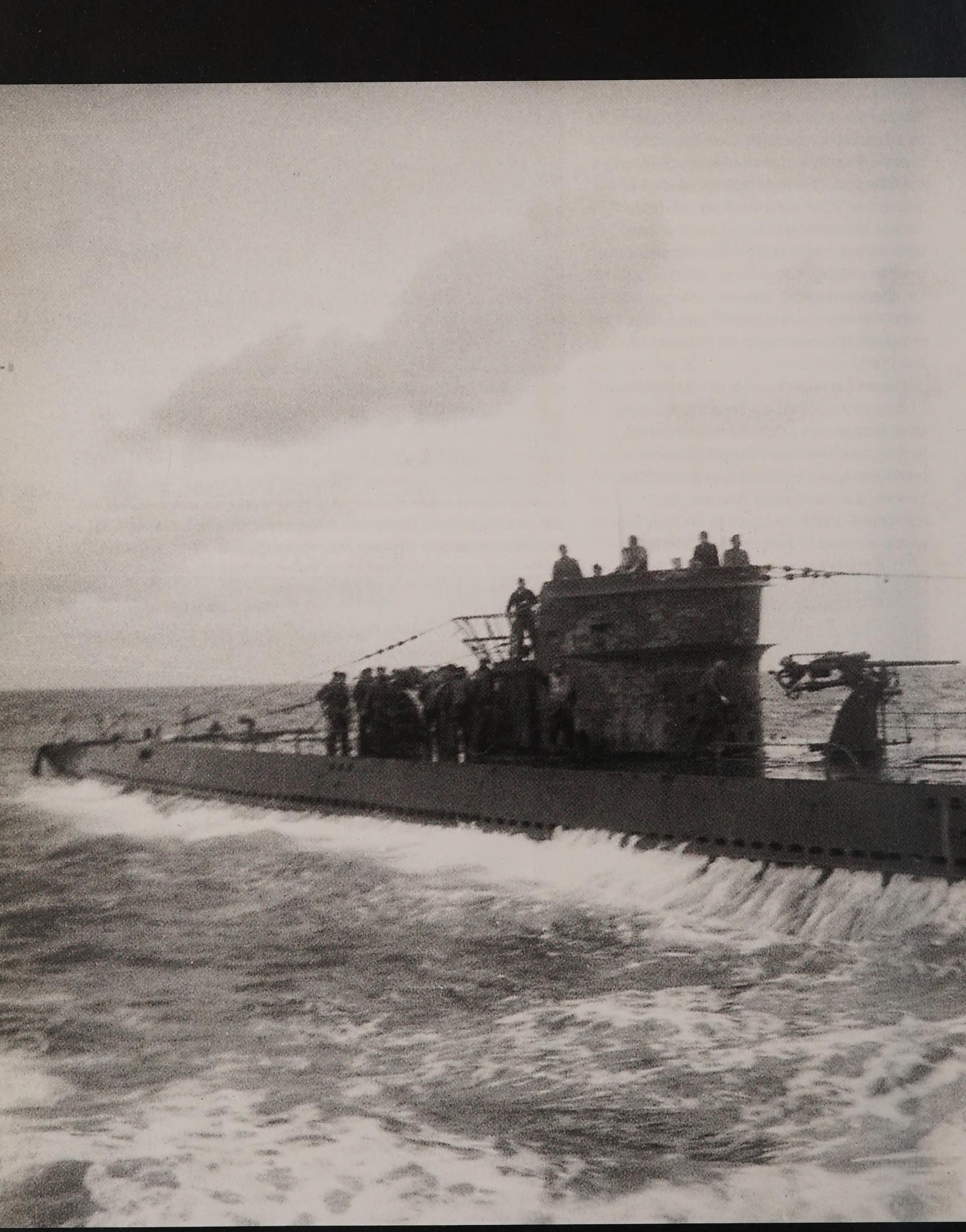
When the Danish government purchased

two Type 205 boats, the German government realised the potential for their submarines as an export commodity. Three **Type 206** boats were sold to the Israeli Navy, becoming the Gal-class. The **Type 209** diesel-electric submarine became the most popular non-nuclear export-sales submarine in the world from the late 1960s and into the first years of the 21st century. With a larger 1,000–1,500 ton displacement the class has seen service with 17 foreign navies, with 63 submarines being built and commissioned between 1971 and 2008.

Germany brought the U-boat name into the 21st century with the new **Type 212** featuring an air-independent propulsion system using hydrogen fuel cells and making it safer than previous closed-cycle diesel engines and steam turbines. It is also cheaper than a nuclear reactor and quieter than both. While Type 212s were purchased by Italy, the **Type 214** was designed as a follow-on export model and sold to the navies of Greece, South Korea and Turkey. Next on the drawing board is the Type 216, a long-range multi-mission two-deck fuel cell submarine with exceptional endurance. The submarine is currently still at the design stage and no vessels have yet been ordered.

BELOW Class 212A submarines rank among the most advanced in the world, not least thanks to their air-independent fuel cell propulsion systems. In the 1990s the German Navy was seeking a replacement for Type 206 submarines. Initial study began on a highly advanced design of non-nuclear submarine developed by Howaldtswerke-Deutsche Werft (owned by ThyssenKrupp Marine Systems) featuring diesel propulsion and an additional air independent propulsion (AIP) system using polymer electrolyte membrane (PEM) hydrogen fuel cells. The submarine was built to operate at high speed on diesel power or switch to an AIP system for silent slow cruising, staying submerged for up to three weeks without surfacing and with no exhaust heat. The system is also vibration-free, extremely quiet and virtually undetectable. *(ThyssenKrupp Marine Systems AB)*





Chapter Two

The U-boat at war

In the closing months of the war the life of a U-boat crewman was barely 60 days. The U-boat service lost 38,000 men while 5,000 were taken prisoner out of a total force of 48,000 men. No branch of an armed force has ever sustained those same losses and remained functioning. In the last months of the war only two out of every 10 U-boats leaving port were expected to return. Most of those lost at sea carried young seamen going out on their first patrol.

OPPOSITE **Type VIIC U-571 (*Kapitänleutnant* Helmut Mohlmann) on patrol during April 1942 refuelling from '*Milchkuh*' Type XIV U-459 (out of shot). U-571 was responsible for sinking five ships before she herself was sunk by depth charges from a RAAF Sunderland flying boat off the west coast of Ireland on 28 January 1944. All hands were lost.** *(Bundesarchiv)*

There are no roses on a sailor's grave,
No lilies on an ocean wave,
The only tribute is the seagulls' sweeps,
And the teardrops that a sweetheart weeps.

German song

The first Type VIIA U-boats were assigned to the 2nd U-boat Flotilla – the *Unterseebootsflottille 'Saltzwedel'* (the Saltzwedel Submarine Flotilla) – which became the Kriegsmarine's second operational U-boat unit. Founded on 1 September 1936 under the command of Fregattenkapitän (Lieutenant Commander) Werner Scheer, the flotilla was based in Kiel for the first weeks after its formation, later moving to Wilhelmshaven until May 1940 when it moved to the Bay of Biscay U-boat base at Lorient following the fall of France.

BELOW Type VIIC boat U-553 returns to St-Nazaire from its second combat patrol on 19 July 1941 after achieving success north of the Azores. She sank the merchant ships *Susan Maersk* (which went down in 90 seconds) and the *Ranella* (which broke in two). In total the boat sank 14 ships for a total loss of 71,779grt on ten different patrols. It is thought that U-553 sank on her tenth patrol due to technical problems and was officially declared missing with all her crew on 28 January 1943. The home-made triangular victory pennants flying above the bridge indicate the approximate tonnage of ships sunk by U-553 during the patrol. *(Bundesarchiv)*

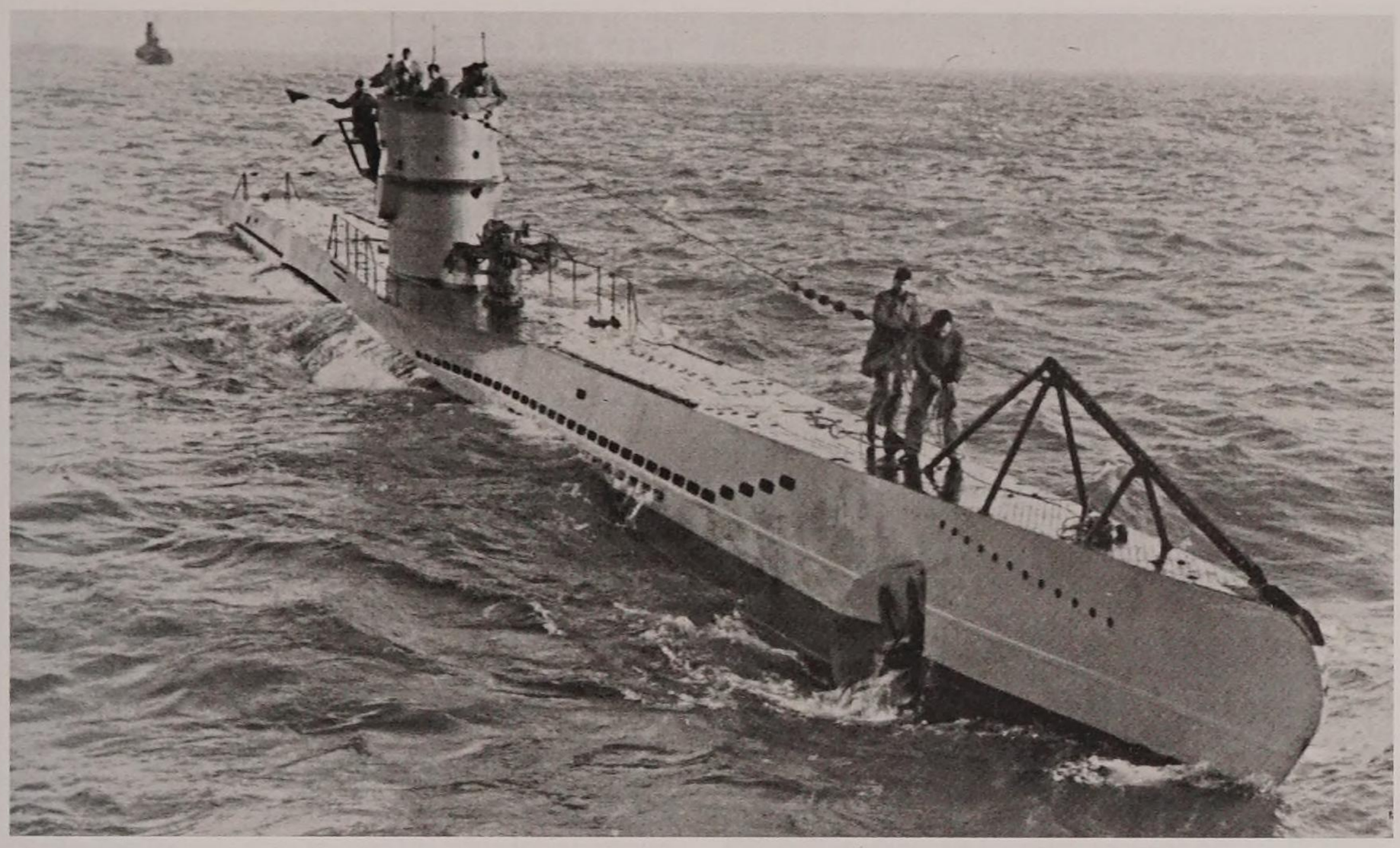
U-27 was one of the first VII class boats delivered to the Kriegsmarine. The submarine, built by AG Weser in Bremen in violation of the Treaty of Versailles, was part of Hitler's 'Plan Z', the name given in January 1939 to his plan to re-equip and expand the German armed forces programme. This called for work to commence immediately, constructing 249 U-boats, 68 destroyers, 90 torpedo boats, 3 battlecruisers plus 5 heavy and 36 M-class light cruisers. Once built, these vessels would challenge Britain's naval power and as each rolled off the production line and was pressed into service, work was allowed to begin on another.

U-27 cost 4,189,000 Reichsmarks to build – roughly US$1.76 million in 1935/36 prices. The vessel left AG Weser's Bremen factory in June 1936 to begin a short career, conducting just one war patrol west of Scotland in which it sank two enemy vessels before it was itself sunk by depth charges from HMS *Fortune* and HMS *Forester*. The boat became the second German submarine to be destroyed in the Second World War, following the sinking of U-39 which had been depth charged a week earlier. U-39's active sea life lasted just 30 days from 23 August to 20 September 1939 – such was the short life of many U-boats during the Second World War. All crewmen survived and were taken prisoner.

It was boats such as U-27 that encouraged the Kriegsmarine to rapidly put their new Type VII submarines through their paces. Shortcomings were highlighted at an early stage, most notably – as in the case of U-27 – malfunctioning torpedoes and problems with deck guns.

Improvements eventually led to the design and build of Type VIIB and VIIC U-boats. These are some of the problems encountered and solutions introduced to boats launched from June 1938 onwards:

- It was discovered that new electronic and communication equipment needed more space inside the boats. This was obtained by lengthening the control room by one half-frame forward and one half-frame aft of the search periscope in VIIB boats, while type VIIC boats were lengthened by one frame.



LEFT U-101 was a Type VIIB class boat that enjoyed a highly successful career. She sank thirty-five ships (totalling 198,218grt), three auxiliary warships (totalling 46,440grt), damaged five ships (totalling 37,965grt) and took one ship as a prize (2,136grt). She was scuttled on 3 May 1945 prior to the German surrender. The wreck was later broken up. *(Karl Parlour)*

- Constricted conning tower dimensions on VIIB boats were increased in width by 60mm and length by 300mm.
- Diving characteristics, especially in heavy seas, were improved by adding pressure-proof negative buoyancy tanks forward of the port and starboard regulating tanks.
- Surface range was improved by increasing the capacity of internal fuel oil tanks. This was achieved by moving the aft bulkhead of the main ballast tank one frame forward. The volume of internal fuel oil tanks was increased from 32.5m³ in type VIIB to 37.9m³ as in type VIIC boats.

VII class U-boats patrolled Britain's west coast via routes around the Shetland Islands and helped carry the war to the north coast of Spain and south to Gibraltar. In November 1939, U-boat commanders were ordered to take their submarines through the English Channel on routes to the Atlantic, but this proved to be a failure following minelaying by the Royal Navy in the narrow Strait of Dover, which caused the route to be abandoned.

German naval staff laid down strict rules on how its U-boat war was to be conducted. It decreed that only merchant ships were to be attacked in accordance with international law. Hitler forbade any passenger ship (and all ships flying the French flag) from being attacked. Despite England and France's declaration of war, Hitler hoped to limit hostilities to Poland and prevent active participation by France in any conflict. But just ten hours after Britain declared war on Germany on 3 September 1939, Kapitänleutnant Fritz-Julius Lemp, commanding Type VIIA submarine U-30, spotted a passenger liner on a bearing perfect for torpedo attack. As

BELOW The 13,581-ton passenger liner SS *Athenia* was the first ship to be sunk by a U-boat in the Second World War. On 2 September 1939, the ship was travelling from Glasgow to Montreal, via Liverpool and Belfast, carrying 1,103 passengers and 315 crew. It was destroyed by Type VIIA submarine U-30 under the command of *Kapitänleutnant* Fritz-Julius Lemp while travelling 200nm west of the Hebrides. *(National Archives of Canada)*

LEFT After sinking the SS *Athenia,* U-30 went on to sink a further two steam freighters by torpedo and gunnery attacks on the same day, including SS *Blairlogie* (pictured).

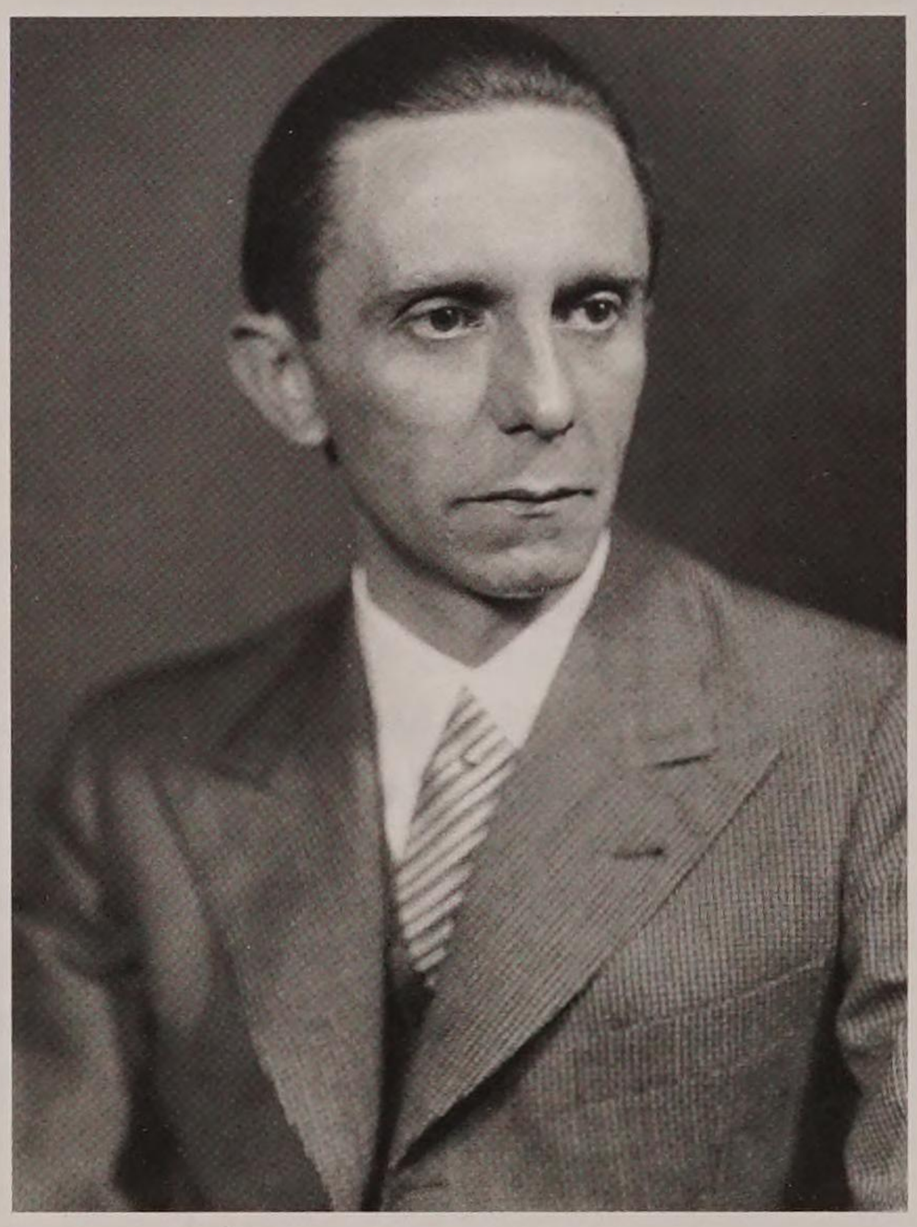
the liner was off normal shipping routes and zig-zagging in a stretch of water 320km west of the Hebrides en route from Liverpool to Montreal, Lemp mistook it for a troopship and after confirming its British nationality, launched an attack. The ship was the 13,581-ton passenger liner SS *Athenia*, which became the first ship sunk in the Second World War. She carried 1,400 passengers and 112 of them, including 28 neutral Americans, perished.

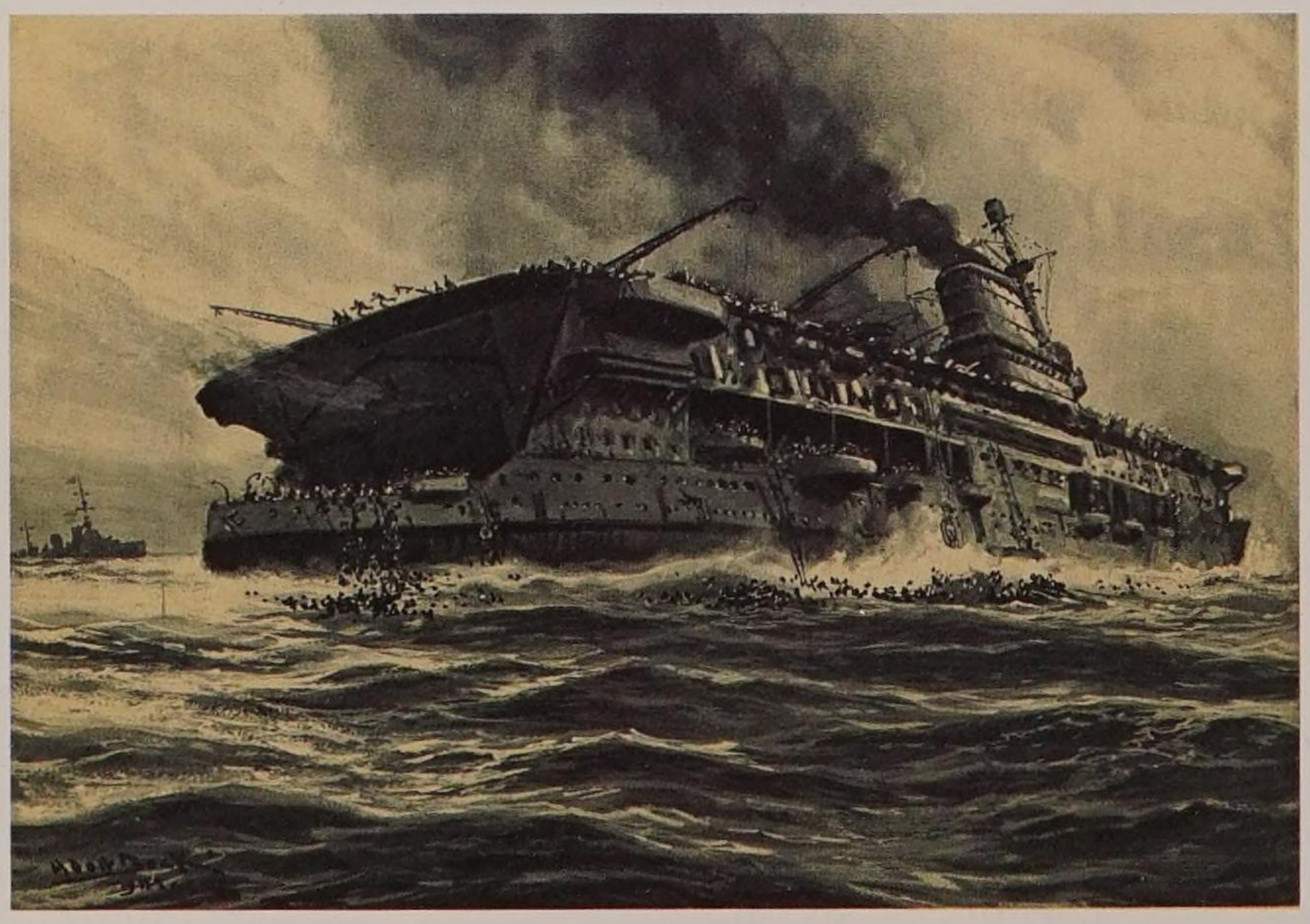
This unfortunate mistake had fateful consequences, presenting the British government with an opportunity to assert that, from the first day of hostilities, Germany had waged unrestricted U-boat warfare. After destroying the SS *Athenia*, U-30 went on to sink two steam freighters by torpedo and gunnery attacks the same day; the 4,425-ton SS *Blairlogie* and the 5,200-ton SS *Fanad Head*. Kapitänleutnant Lemp permitted 33 crew and 8 passengers from the *Fanad Head* and 30 crew from the *Blairlogie* to abandon their ships by lifeboats, before sinking their vessels.

Following the attack, Reich Propaganda Minister Joseph Goebbels claimed that 'there was not a single U-boat in the vicinity of the *Athenia* on the day of her sinking,' accusing Britain of torpedoing its own vessel 'in an attempt to bring the United States into the war on the side of the Allies'.

Britain was in for another shock on 17 September 1939. HMS *Courageous*, originally built as lead ship of the Royal Navy's Courageous class cruisers during the First

RIGHT Reich Propaganda Minister Joseph Goebbels claimed that 'there was not a single U-boat in the vicinity of the *Athenia* on the day of her sinking' and accused Britain of torpedoing its own vessel 'in an attempt to bring the United States into the war on the side of the Allies'.





LEFT On 17 September 1939, Royal Navy aircraft carrier HMS *Courageous* was stalked for over two hours by Type VIIA submarine U-29 commanded by *Kapitänleutnant* Otto Schuhart. As the ship turned into the wind, the U-boat fired three torpedoes, two of which struck the vessel on her port side. The battlecruiser sank in 20 minutes with the loss of her crew of 519. *(Erich Klinghammer, Berlin)*

World War, was now serving with the Home Fleet. With Squadrons 811 and 822 aboard and each equipped with a dozen Fairey Swordfish aircraft, HMS *Courageous* was one of the vessels involved with the Royal Navy's hunter-killer groups, formed around the fleet's aircraft carriers to hunt and destroy U-boats. On 31 August 1939 HMS *Courageous* embarked the two squadrons of Swordfish and departed Plymouth on the evening of 3 September on anti-submarine patrols in the Western Approaches escorted by four destroyers. On the evening of 17 September, she was on one such patrol off the coast of Ireland. Two of her four escorting destroyers had been sent to help a merchant ship under attack and all her aircraft had returned from patrols. During this time, *Courageous* was stalked for over two hours by Type VIIA boat U-29, commanded by Kapitänleutnant Otto Schuhart. The carrier turned into the wind to launch her aircraft, putting the ship right across the bow of U-29, which fired off three torpedoes. Two torpedoes struck the ship on its port side before any aircraft had time to take off. All electrical power was knocked out. The cruiser capsized and sank 20 minutes later with the loss of 519 of her crew, including her captain. The survivors were rescued by the Dutch liner *Veendam* and the British freighter *Collingworth*. Although the two escorting destroyers counter-attacked U-29 for four hours, the submarine escaped.

The loss of the SS *Athenia* and HMS *Courageous* forced Britain to position ships outside the protection of international law and use weapons for their own defence. At the same time the Kriegsmarine 'officially permitted' U-boats to attack without warning any merchantman whose armament was recognised. Britain publicly declared that all its merchant shipping would in future be armed, resulting in open season for U-boat crews to attack any non-German merchant ship they encountered escorting enemy warships. Churchill instructed British merchant ships to be blacked out at night and any vessels encountering a U-boat were ordered to ram them on sight.

Germany predicted that over 572 British and Allied ships would be destroyed between September 1939 and September 1940 – and

Nr. 189 – 15. August 1940

gegen Engeland

MARINE-FRONTZEITUNG DER NORDSEE

Feige britische Bombardierung der Wohnviertel Mailands

U-Boot versenkte 41611 Tonnen

U-Jäger gegen britische Zerstörer - Bilanz von Dienstag: 132 englische Flugzeuge und 12 Sperrballone

Italienische Aktion in Britisch-Somaliland entwickelt sich trotz heftigen Widerstandes planmäßig

Deutscher Wehrmachtsbericht

Italienischer Wehrmachtsbericht

ABOVE ***Against England*, an August 1940 German propaganda newspaper extolling the successes of the German – and to a much lesser extent, Italian – submarine corps.** *(Karl Parlour)*

BELOW During the Second World War the North Sea was a busy route for U-boats operating out of Hamburg and Kiel heading on patrol into the Atlantic waters and further afield. Accurate tidal analysis and prediction were of vital importance for U-boat crews operating in comparatively shallow waters and in 1942, at the height of Germany's U-boat campaign, the Kriegsmarine's main marine observatory at Wilhelmshaven published a folder of 21 tidal harmonic constant charts showing the variation in tidal amplitude and times at different locations in the North Sea. This North Sea map was intended 'for official use only'. *(www.coloptics.com)*

OBERKOMMANDO DER KRIEGSMARINE

Nr. 2752
PrüfNr. 554

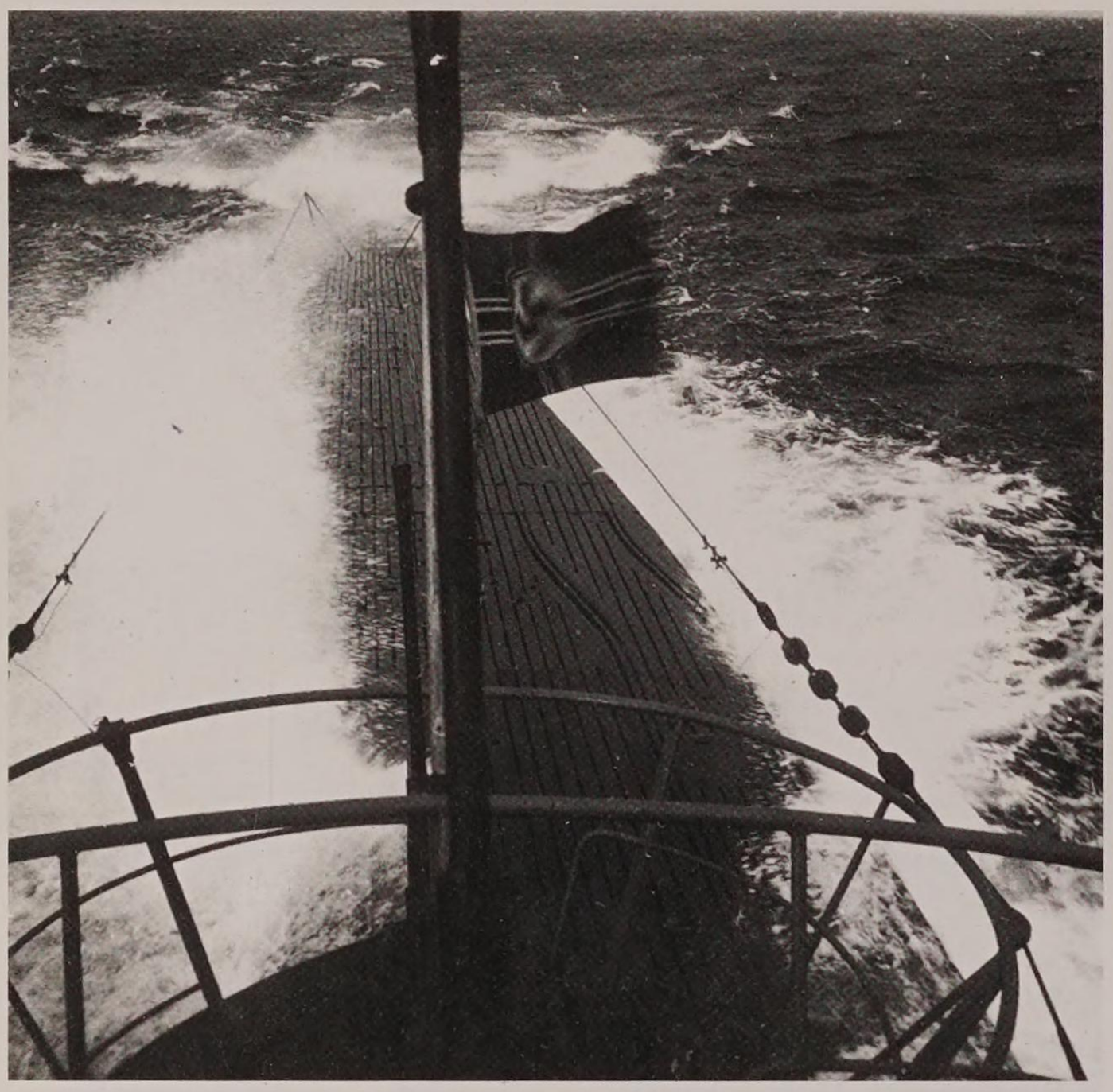
Nur für den Dienstgebrauch!

KARTEN
DER
HARMONISCHEN
GEZEITENKONSTANTEN
FÜR DAS GEBIET DER
NORDSEE

Ausgabe A

Herausgegeben vom
MARINEOBSERVATORIUM WILHELMSHAVEN
1942

9



ABOVE This U-boat is about to lower its flag prior to crash-diving and searching for enemy vessels. *(Through Their Eyes)*

they were not far wrong. In the first nine months of the war 2.3 million tons of British and Allied shipping was sunk, a loss rate that Britain could not sustain.

Type II and VII class boats were ordered to stalk British ports giving berths to military or merchant shipping and vessels moving through sea lanes leading to them. They were told to observe operations from submerged positions as close to the shoreline as possible. Ports housing potential targets included Scapa Flow, Moray Firth, the Firth of Forth, areas surrounding the Shetland Islands, Loch Ewe, Liverpool and the English Channel. At the same time, Type VIIC boats were assigned to North Atlantic traffic approaching the British coastline, while Type IXC boats were dispatched to operations off Spain and Gibraltar.

U-47 and 'The Bull of Scapa Flow'

Britain's major naval base at Scapa Flow, a body of sheltered water in the Orkney Islands off north-east Scotland, provided the Kriegsmarine with particular problems and challenges dating back to the First World War.

Scapa Flow was the place where Germany's

BELOW A general view of the Royal Navy's anchorage at Scapa Flow in the Orkneys. *(Jonathan Falconer collection)*

LEFT The German High Seas Fleet was interned at the Royal Naval Base at Scapa Flow after the Armistice at the end of the First World War. Fifty-two vessels were scuttled by the Germans on 21 June 1919 to prevent their reuse by the British, including the 26,180-ton battlecruiser SMS *Derfflinger*. She was raised in 1939, together with 32 other vessels, for their value as scrap (pictured here) and was anchored, still capsized, off the island of Risa until 1946. *Derfflinger* was then towed to Faslane where she was broken up. *(Jonathan Falconer collection)*

Imperial Navy surrendered their ships in 1918. At the start of the conflict, Britain's Admiral of the Fleet, John Jellicoe, recognised the possibility of submarine or destroyer attacks on ships anchored in Scapa Flow's natural harbour, which provided perfect anchorage for his warships, despite a water depth of not more than 60m (200ft) and in other places 30m (98ft). Jellicoe ordered the base to be reinforced with minefields, artillery and submerged concrete barriers. Only two attempts to enter the ports were made by U-boats – neither of them successful. U-18 tried to enter in November 1914, but a trawler searching for submarines rammed it, causing the submarine to flee before sinking. A second attempt was made in October 1918 by UB-116, but the submarine was unable to deal with the sophisticated defences in place and was spotted before entering port. It was destroyed by shore-triggered mines.

Following Germany's 1918 defeat, 74 German ships were interned at Gutter Sound, an inlet of Scapa Flow, while the British government made up its mind what to do with the vessels and their crews. After six months of waiting, Rear Admiral Ludwig von Reuter, in charge of the captive navy vessels, ordered the fleet to be scuttled to prevent them from falling into British hands. Von Reuter chose his moment carefully and gave the order while the British fleet was away from Gutter Sound on manoeuvres. None of the British at Scapa Flow were aware that for six months German crews had spent their time waiting for the scuttle order to be given, welding bulkhead doors open, laying charges in vulnerable parts of the ships and dropping important keys and tools overboard so valves could not be closed. The few Royal Navy sailors still present at Scapa Flow made desperate efforts to board the ships and prevent them from sinking, managing to beach the battleship *Baden* and light cruisers *Nürnberg*, *Frankfurt* and *Emden* along with 18 destroyers. But the remaining 52 ships, the bulk of defeated Germany's High Seas Fleet, was sunk without loss of life, although nine German sailors died when British forces opened fire as they attempted to scuttle their ship. They became the last casualties of the First World War.

Because of its distance from north German airfields, Scapa Flow was again selected as the main British naval base for the Home Fleet during the Second World War. But the strong defences installed during the First

RIGHT
***Kapitänleutnant* Günther Prien was a German U-boat ace during the early part of the Second World War. The 31-year-old submarine commander was hand-picked by Dönitz to take his Type VII boat U-47 on a surprise attack on Royal Navy ships berthed at their primary base at Scapa Flow in October 1939.** *(Bundesarchiv)*

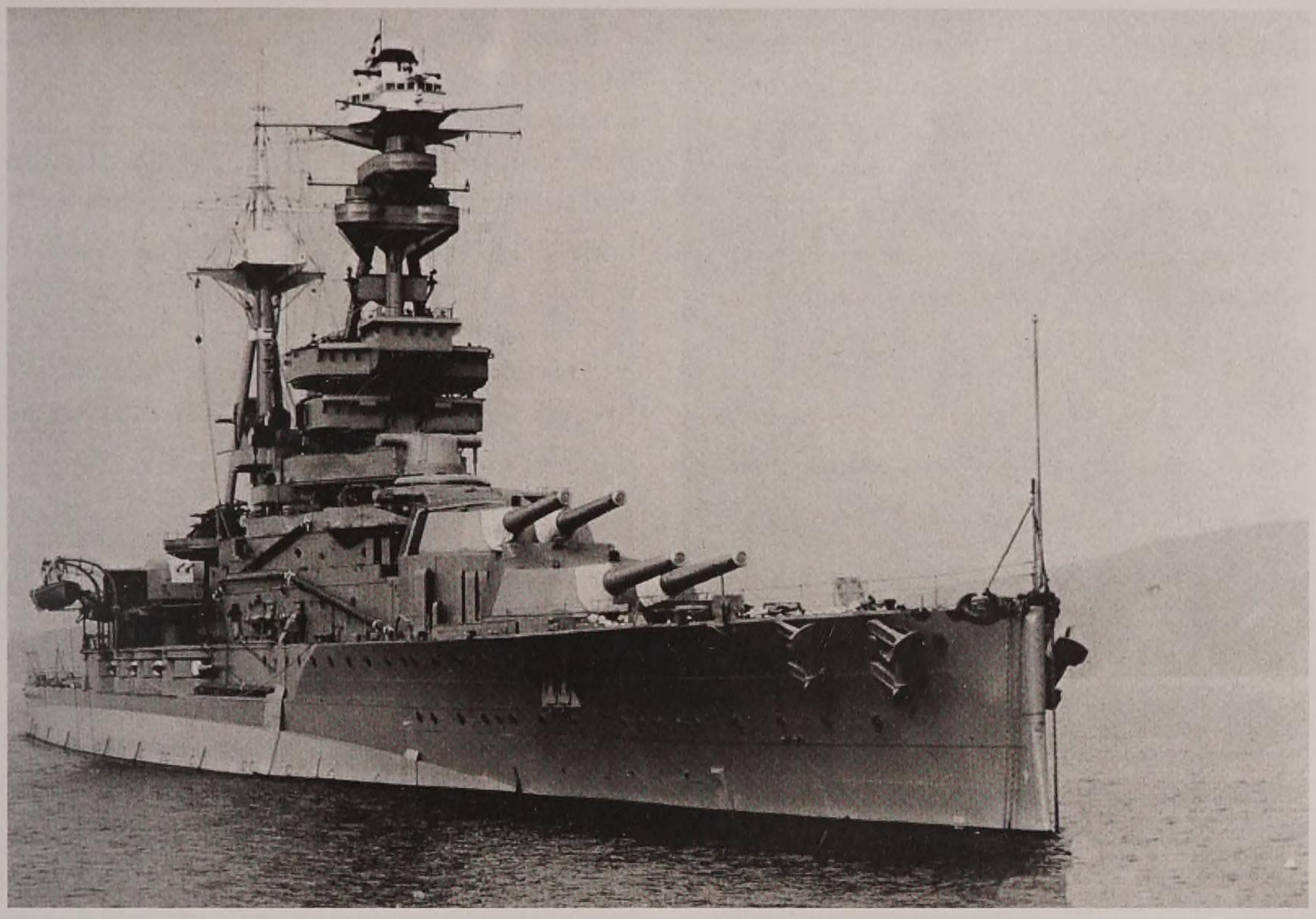
World War had fallen into disrepair, making them inadequate against air attack, while the concrete blocks sunk to prevent U-boats from penetrating had collapsed. While anti-submarine nets made from single-stranded looped wire were in place over the three main entrances, they were to prove inadequate for preventing a Type VII submarine from entering port submerged. There was also a lack of destroyers and other anti-U-boat craft patrolling the area. As a result, efforts to repair neglected defences were made too late to prevent disaster.

Dönitz knew about Scapa Flow's shortcomings and was determined to make the world sit up and take notice of what his U-boats were capable of achieving under the nose of their old enemy. Within days of the outbreak of war, he devised a plan for a submarine to spring a surprise attack on British vessels anchored there. Dönitz had two reasons for the surprise submarine strike. The first was an attempt to displace British Home Fleet ships from Scapa Flow and second to slacken Britain's North Sea blockade to give the Kriegsmarine greater freedom to attack Atlantic convoys. The unexpected blow would also be a symbolic act of vengeance, striking at the same location where Germany's High Seas Fleet had earlier surrendered and scuttled itself following the 1918 defeat.

Dönitz hand-picked 31-year-old former merchant seaman and now a submarine commander Kapitänleutnant Günther Prien of the 7th U-boat Flotilla for the task. Prien was of medium height and a stocky frame, fair-headed and square-jawed. He was told that the mission would involve him taking his U-boat through shallow water, unknown shoals, tricky currents and possible detection by the enemy to penetrate the Royal Navy at Scapa Flow.

Dönitz regarded Prien as 'a clear thinker not given to complex pondering'. Six weeks earlier Prien's Type VIIB submarine U-47, with a crew of 44 men (average age 19), had intercepted the unescorted British merchant steamer *Bosnia*, which refused to heed verbal warnings to surrender and was fired on by the submarine's 20mm deck guns. Prien allowed its stricken crew of 32 to abandon ship in a lifeboat, later to be picked up by a neutral ship bound for Lisbon. Prien sent the steamer to the bottom of the Atlantic with a torpedo, making it the second U-boat kill of the war. Two more British vessels became U-47 victims over the next two days. Dönitz recognised that Prien had just the kind of daring qualities he wanted for the raid he planned on the British Home Fleet on the night of 14 October 1939, when tides would be high and the night moonless over Scapa Flow.

Prien kept details of the mission secret from his crew, although each officer and rating had been invited to volunteer for what they were promised would be 'a highly dangerous mission'. During the late evening hours of 13 October 1939, Prien summoned the crew to U-47's torpedo room and divulged the secret of their special mission. He told them that once inside Scapa Flow they would 'wreak havoc'. He told them: 'First we are going to sink aircraft carriers, then battleships and cruisers and all we can get.' He assured his young crew that the Kriegsmarine was confident U-47 could get inside Holm Sound where most of the British Home Fleet lay at anchor – but Prien gave no guarantee that they would get out again. If the U-boat was unable to fulfil its objective within an allocated time, it would be trapped by the tide. 'But I am determined to get in and do what we have to do and get you all out again and back home,' Prien told his men.



LEFT U-47 fired a salvo of torpedoes into the British battleship HMS *Royal Oak,* sinking the vessel and killing 833 sailors – over 100 of them boys under the age of 18.

Just before midnight on 14 October at 00.27 hours, U-47 silently entered Kirk Sound at the narrow approaches to Scapa Flow and Prien entered the following into his logbook: *'Wir sind in Scapa Fluss!!'* ('We are in Scapa Flow!!'). Although most of the British Home Fleet had left the area a few days before, a lookout on U-47's bridge spotted a prize at 00.58 hours – 30,000grt of HMS *Royal Oak* lying at anchor approximately 4,400 yards (4,000m) to the north. Prien – known to friends as 'Prüntje' or 'Little Prien' and his crew as 'de Alte' or 'the Old Man' – ordered a pair of torpedoes to be fired in the ship's direction. The torpedoes did little more than sever an anchor chain but on realising that there was no immediate threat from any surface vessels, Prien ordered more torpedoes to be fired from the U-47's stern tubes, which struck the battleship in quick succession amidships and detonated. As HMS *Royal Oak* began sinking and 833 seamen died with their ship – over 100 of them boy sailors under the age of 18 years – U-47 left Scapa Flow as quietly and quickly as she had entered and headed for home.

Kept secret by the German naval command for some years was the fact that Prien had fired a total of seven torpedoes at his target, of which five failed because of long-standing problems with their depth steering and magnetic detonator systems. These problems continued to bedevil Type VII boats for most of the war years, particularly during the German invasion of Norway when U-boats were unable to keep the Royal Navy at bay.

The Nazi propaganda machine was quick to capitalise on the successful raid and newspapers plastered their front pages with stories about U-47's triumph and Prien's bravado. In a cinema newsreel interview, Prien told German audiences:

> *Inside of Scapa Flow, the harbour of the English sea force, it was absolutely dead calm in there. The entire bay was alight because of bright northern lights. We then cruised in the bay for approximately one and a half hours, chose our targets, fired our torpedoes. In the next moment there was a bang and a moment after the Royal Oak blew up. The view was indescribable. And we sneaked out, in a similar fashion as we got in, past the enemy guards who did not see us. You can imagine the excitement and happiness we all felt, about the fact that we managed to fulfill our task and achieve such a huge victory for Germany.*

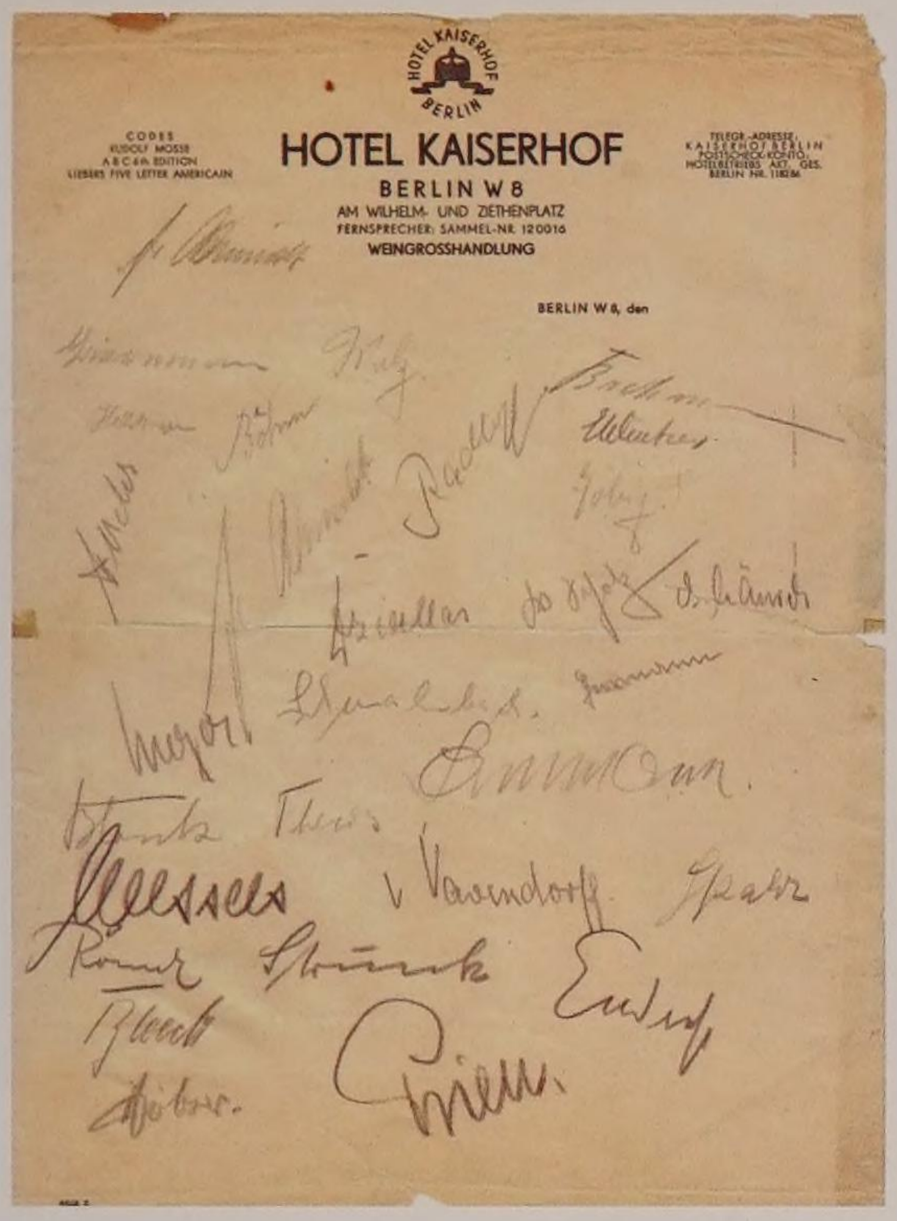
ABOVE Prien and his U-47 crew return home to Wilhelmshaven and instant fame, plus personal greetings from Dönitz after sinking HMS *Royal Oak* at Scapa Flow. *(Imperial War Museum)*

The story was strongly felt throughout Germany. When Prien and his crew approached their home port at Wilhelmshaven in U-47 at lunchtime on 17 October, they were greeted as heroes. Newsreel cameramen were taken out to meet the submarine and film the men's triumphant homecoming. It was from these reporters that Prien learned he had been awarded the Knight's Cross with Oak Leaves, while each crew member was to receive an Iron Cross Second Class.

Brass bands played on the Wilhelmshaven jetty and cheering crowds of sailors and local people lined the harbour walls to cheer the triumphant crew home. Raeder and Dönitz were also waiting on the dock to shake hands with every crew member as they lined up on deck. Later the same day Hitler sent three aircraft to fly Prien and his crew to Berlin and thousands more lined the streets to catch a glimpse of the submarine ace and his brave men as they drove to the Reichstag building. There Prien was decorated with the Knight's Cross of the Iron Cross in recognition of extreme battlefield bravery and successful military leadership. The Knight's Cross was the first to be presented to a German submarine officer and later became the customary decoration for successful U-boat commanders. Dönitz himself was rewarded by promotion from Commodore to Rear-Admiral and made Flag Officer of U-boats.

Prien became the first naval hero of the Second World War and instantly became a national champion, nicknamed '*Der Stier von Scapa-Fluss*' ('The Bull of Scapa Flow'). He was idolised by adults and children alike, his image appeared on cinema newsreels, picture postcards and posters. He was followed everywhere by reporters and photographers and patriotic songs were composed in his

RIGHT Prien and his U-boat crew of 44 men (whose average age was 19) were flown to Berlin in Hitler's personal aircraft, where 'The Bull of Scapa Flow' was personally awarded the Knight's Cross of the Iron Cross by the Führer and became the first sailor of the U-boat service and only the second member of the Kriegsmarine to receive this award. The rest of the crew were awarded the Iron Cross (Second Class). On the left is *Großadmiral* Erich Raeder; Prien is beside Hitler. *(Bundesarchiv)*


HOTEL KAISERHOF
BERLIN

CODES
RUDOLF MOSSE
A B C 6th EDITION
LIEBERS FIVE LETTER AMERICAIN

HOTEL KAISERHOF
BERLIN W 8
AM WILHELM- UND ZIETHENPLATZ
FERNSPRECHER: SAMMEL-NR. 120016
WEINGROSSHANDLUNG

TELEGR.-ADRESSE:
KAISERHOF BERLIN
POSTSCHECK-KONTO:
HOTELBETRIEBS AKT. GES.
BERLIN NR. 118284

BERLIN W 8, den

LEFT In Berlin, Prien and his crew were accommodated in style at the luxury Hotel Kaiserhof in the Wilhelmplatz – next door to the Reich Chancellery in what was at the time Berlin's 'government quarter'. After receiving their medals, the U-47 heroes enjoyed a lavish banquet with champagne and fine wines at the hotel. At the end of the evening they signed their names on a piece of hotel stationery as a souvenir of the occasion. Prien's autograph appears at the bottom centre of the page. *(Colonel French MacLean, US Army (Ret.))*

honour. Every German schoolboy wanted to join U-47's crew.

'The Bull of Scapa Flow' and his crew decorated U-47's conning tower with a snorting bull mascot, which was later adopted as the emblem of the 7th U-boat Flotilla. Under Günther Prien's command, U-47 went on to sink over 30 Allied ships, totalling nearly 200,000grt.

No official record exists of what happened to U-47, Günther Prien, his 45 crewmen or how the submarine became lost at sea. U-47 left its base in Lorient, France, on 20 February 1941 on its tenth patrol of Atlantic waters. Several possibilities have been suggested including hitting a mine, falling victim to her own circling torpedoes or mechanical failure. Before going missing she had attacked convoy OB-290 and sank four ships with a total of 16,310grt. But what happened after that remains a mystery. Prien's death at the age of 33 was kept secret until 23 May when it was reluctantly announced that this 'brave hero of the Fatherland died fighting for his country'. Prien's record stands high among U-boat aces of the Second World War (see page 151).

First Lord of the Admiralty Winston Churchill personally announced the loss of HMS *Royal Oak* to the House of Commons. He stated that the U-47 had demonstrated 'a remarkable exploit of professional skill and daring', before declaring that the loss of *Royal Oak* would 'not materially affect the naval balance of power'.

BELOW A patriotic song was written praising Günther Prien's Scapa Flow success called 'Because We Sail Against England!' The lyrics were printed on to a sheet alongside a photograph of Prien and a drawing of U-47 firing torpedoes into HMS *Royal Oak*. One of the verses reads:

Give me your hand, your white hand,
Farewell my love, goodbye my love,
Farewell, farewell,
We sail because we drive,
Because we sail against England!

. . . denn wir fahren
gegen Engeland!

Kptlt. Günther Prien

Heute wollen wir ein Liedchen singen,
trinken wollen wir den kühlen Wein,
und die Gläser sollen dazu klingen,
denn es muß, denn es muß
geschieden sein.

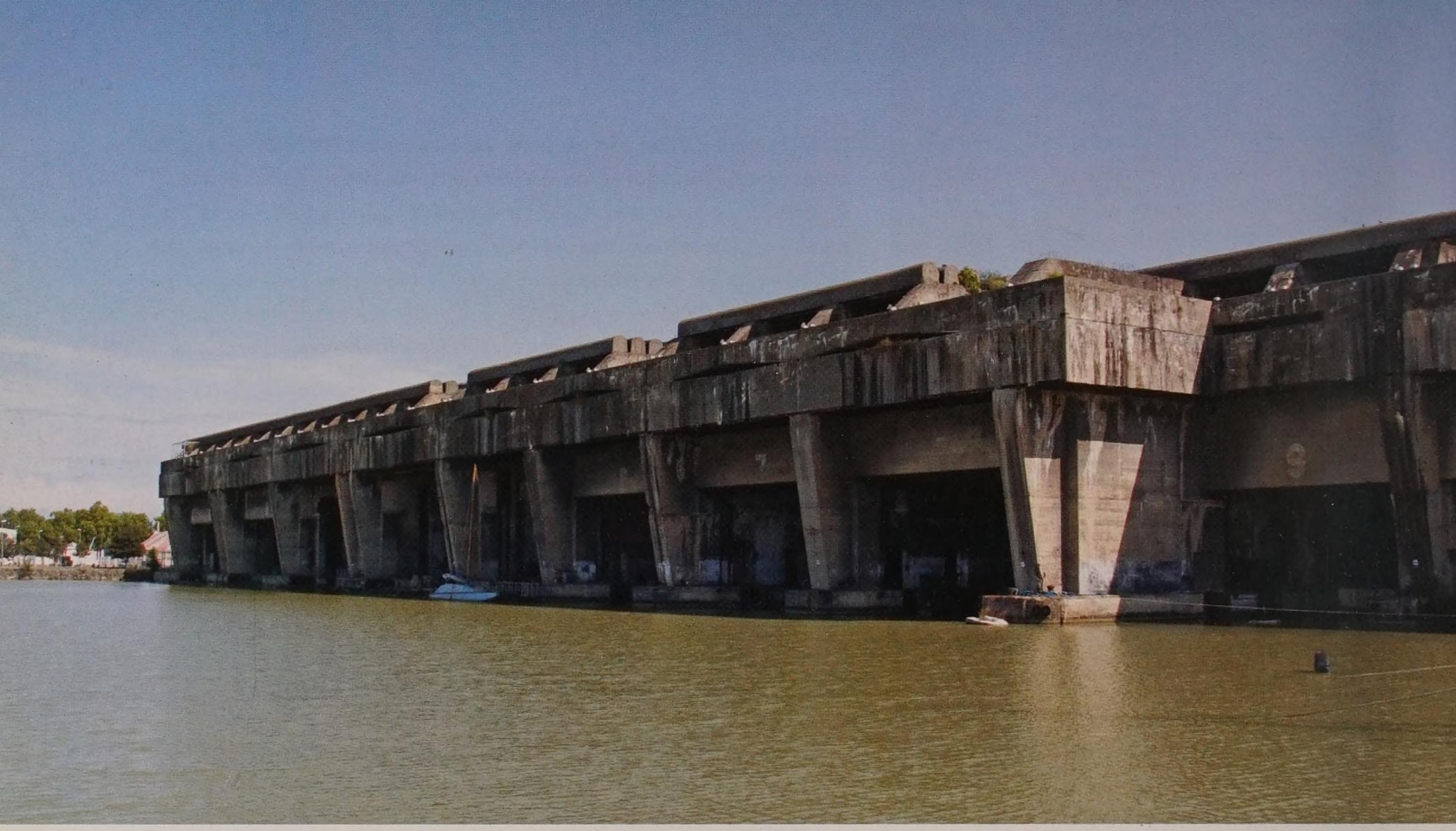
Reich' mir deine Hand,
deine weiße Hand,
Leb' wohl, mein Schatz, leb' wohl!
Denn wir fahren, denn wir fahren,
wir fahren gegen Engeland!

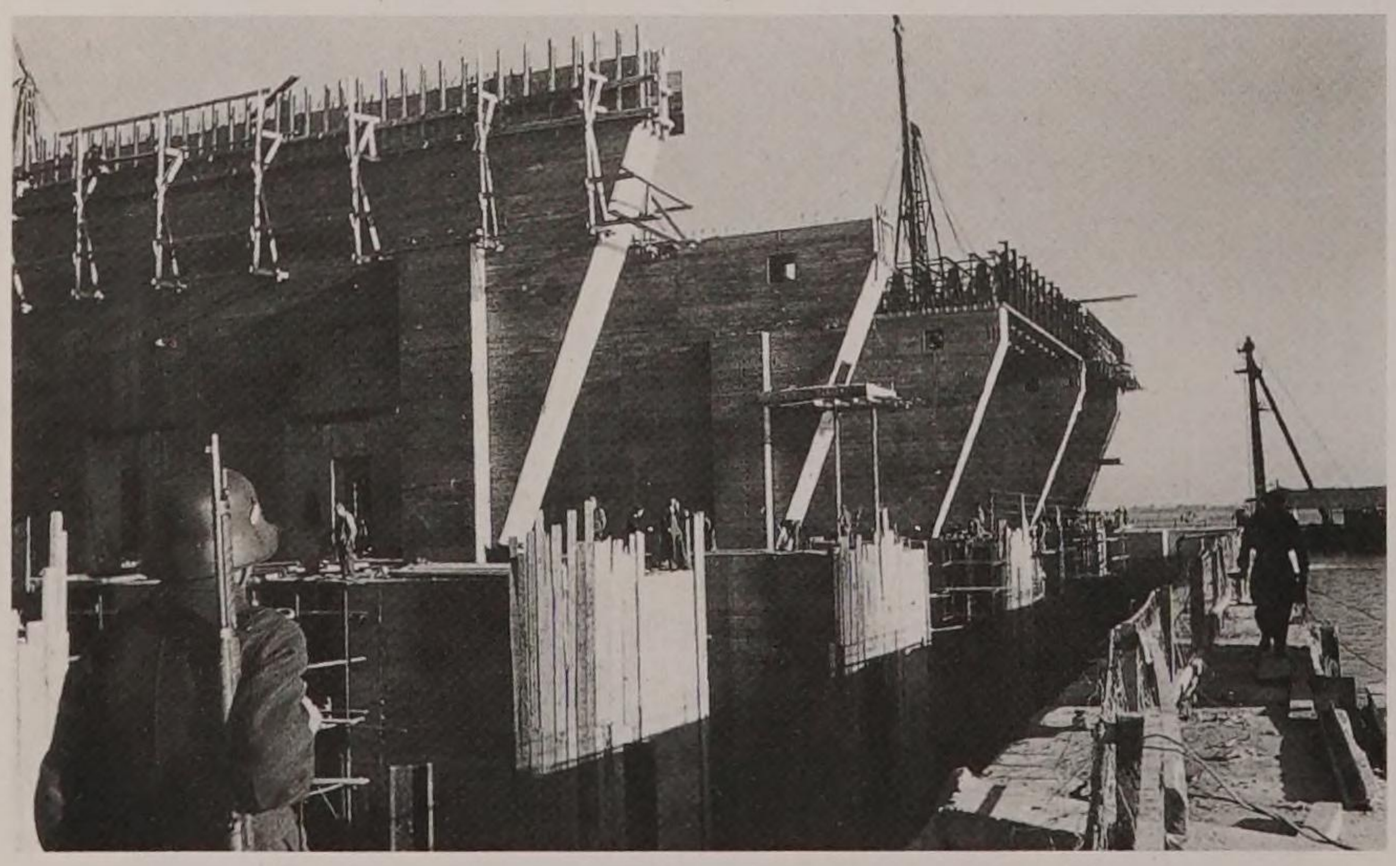
Unsere Flagge wehet auf dem Maste,
sie verkündet uns'res Reiches Macht,
und wir wollen es nicht länger leiden
daß ein Englischmann darüber lacht.
Reich' mir deine Hand . . .

Kommt die Kunde, daß ich bin gefallen,
daß ich schlafe in der Meeresflut,
weine nicht um mich, mein Schatz, und denke
für das Vaterland, da floß mein Blut.
Reich' mir deine Hand . . .

Kptlt. PRIEN torpediert die „Repulse" und vernichtet die „Royal Oak"

Schuchert-Hamburg





ABOVE **The massive U-boat pens at Bordeaux are still standing today thanks to their indestructible reinforced concrete construction that was designed to withstand aerial bombardment.** *(Tony Hisgett/Wikimedia Commons)*

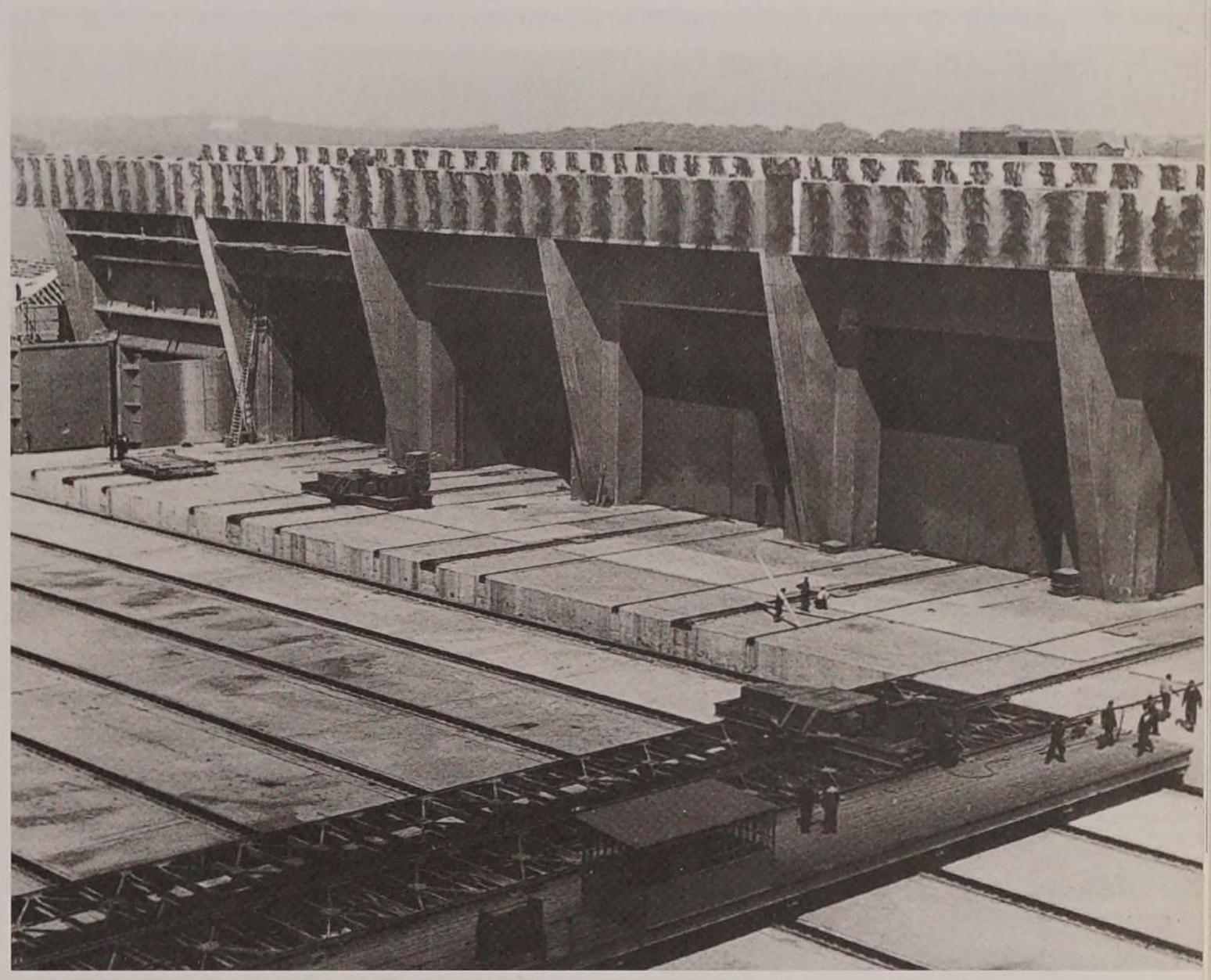
Churchill was obliged to respond to questions as to why *Royal Oak* had had so many boy sailors on board, almost all of whom lost their lives. He defended the centuries-old naval tradition of sending boys aged 15–17 to sea, but the practice was quietly discontinued after the Scapa Flow disaster and sailors under 18 only served on active warships in the most exceptional circumstances.

Atlantic coast U-boat bases

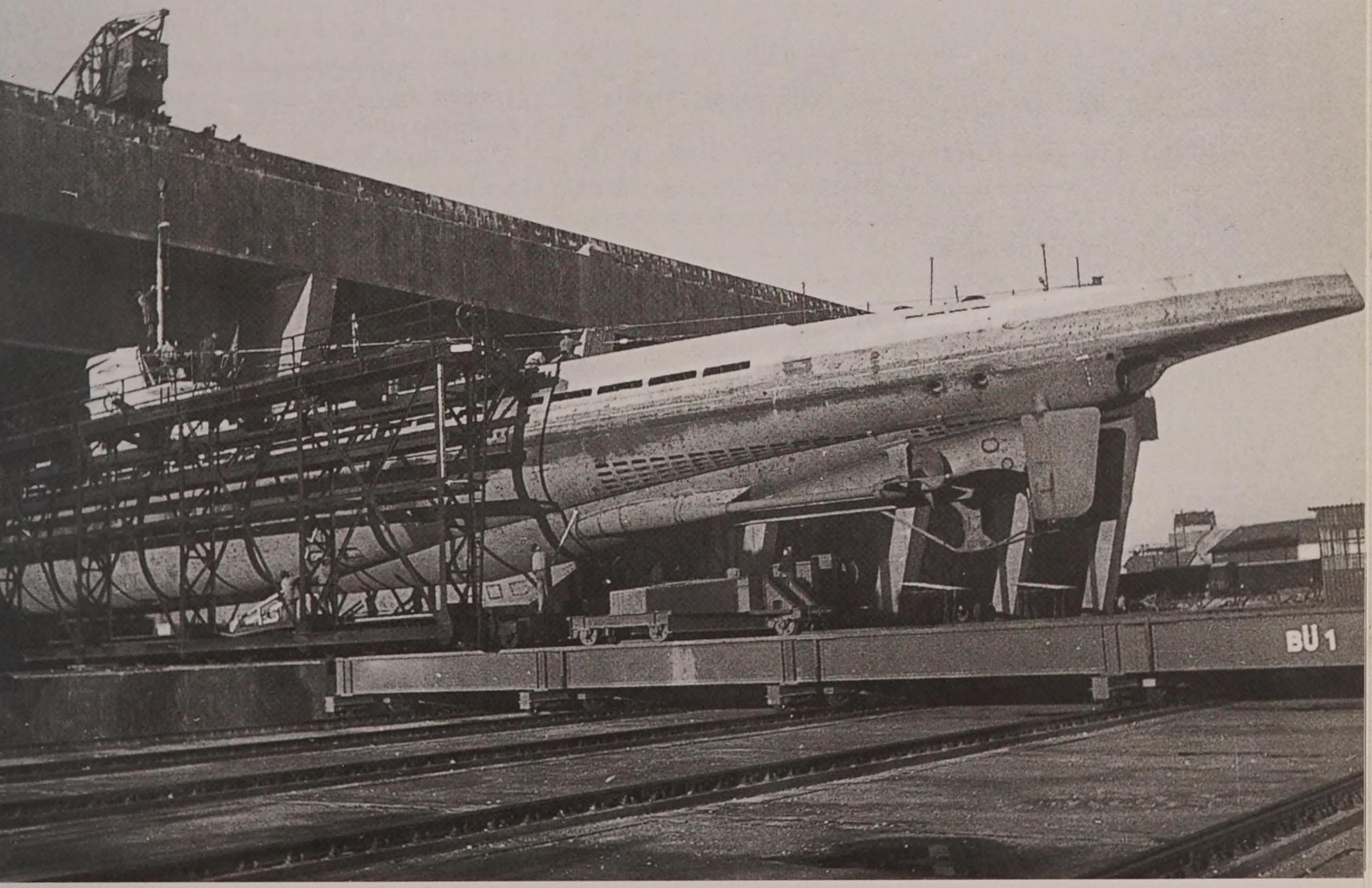
The fall of France in May/June 1940 meant that U-boats no longer had to circumnavigate the British Isles to reach

CENTRE AND LEFT **Construction of the giant U-boat pens at Lorient in Brittany by Organisation Todt labourers, supervised by the Wehrmacht.** *(Bundesarchive)*

convoys, nor pass through the dangerous English Channel. The Kriegsmarine established five U-boat bases along the Bay of Biscay between 1941 and 1942 at Brest, Lorient, St-Nazaire, La Rochelle and Bordeaux. They provided U-boats with closer access to shipping routes and many commanders returned to the French bases as heroes. It was at these ports that the Kriegsmarine, in association with Organisation Todt – the Third Reich civil and military engineering group – used forced labour to built massive reinforced concrete submarine bunker pens to provide shelter and repair facilities for boats, crews, engineers and fuel storage facilities.



RIGHT AND BELOW The slipway on the landward side of the pens was completed in the summer of 1941 and the first U-boat was dry-docked. *(Bundesarchive)*



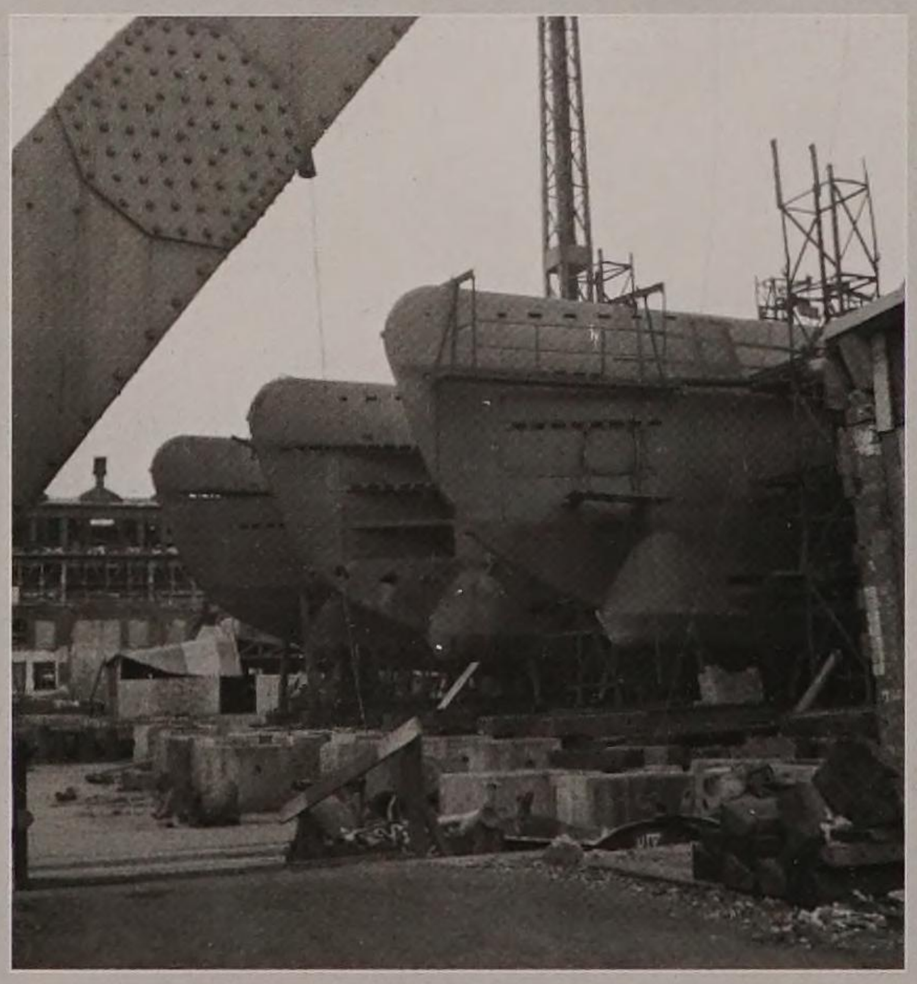
ABOVE The once-busy Blohm & Voss Hamburg-Steinwerder U-boat production line in Hamburg at a standstill. This photograph was taken following the 1945 German surrender after inmates from its forced labour concentration camp had been liberated. A memorial stands on the site of the camp and the company continues to pay undisclosed amounts to the Fund for Compensation of Forced Labourers. Here, eight U-boats await completion, but were scrapped shortly after.

SKILLED AND FORCED LABOUR, U-BOAT FACTORIES AND BASES

Sixteen shipyards in ten different German cities were responsible for building Type VII U-boats and other submarines. Collectively they employed tens of thousands of men and women – skilled and unskilled, locally hired and forced labour – to build vessels throughout the day and night between 1938 and 1944. Men from 16 to 60 and women aged 18–45 had to make themselves available to serve Germany in the so-called *Arbeitsdienst* – working 'for the public benefit' – in jobs that they may, or may not, have been suited to. Many were drafted into shipyards where U-boats were constructed.

The main U-boat shipyards were:

- F. Krupp Germaniawerft AG in Kiel.
- Bremer Vulkan-Vegesacker Werft in Bremen-Vegesack.
- Flender Werke AG in Lübeck.
- Nordseewerke in Emden.
- Flensburger Schiffsbau-Gesellschaft in Flensburg.
- Howaldtswerke AG in Kiel.
- Danziger Werft AG in Danzig.
- F. Schichau GmbH in Danzig.
- Blohm & Voss in Hamburg.
- Howaldtswerke Hamburg AG in Hamburg.
- H. C. Stülcken Sohn in Hamburg .
- Kriegsmarinewerft (KMW) in Wilhelmshaven.



RIGHT Incomplete U-boats abandoned at the Blohm & Voss shipyard following the German surrender, 4 May 1945. *(Imperial War Museum)*

FAR RIGHT Three U-boats in a submarine pen at Trondheim, 19 May 1945. Type VII and Type IX submarines can also be seen alongside each other outside the 'Dora I' submarine pen. *(Imperial War Museum)*

- Oderwerke AG in Stettin.
- Stettiner Maschinenbau AG in Stettin.
- Flender Werke AG in Lübeck.
- Neptun Werft AG in Rostock.

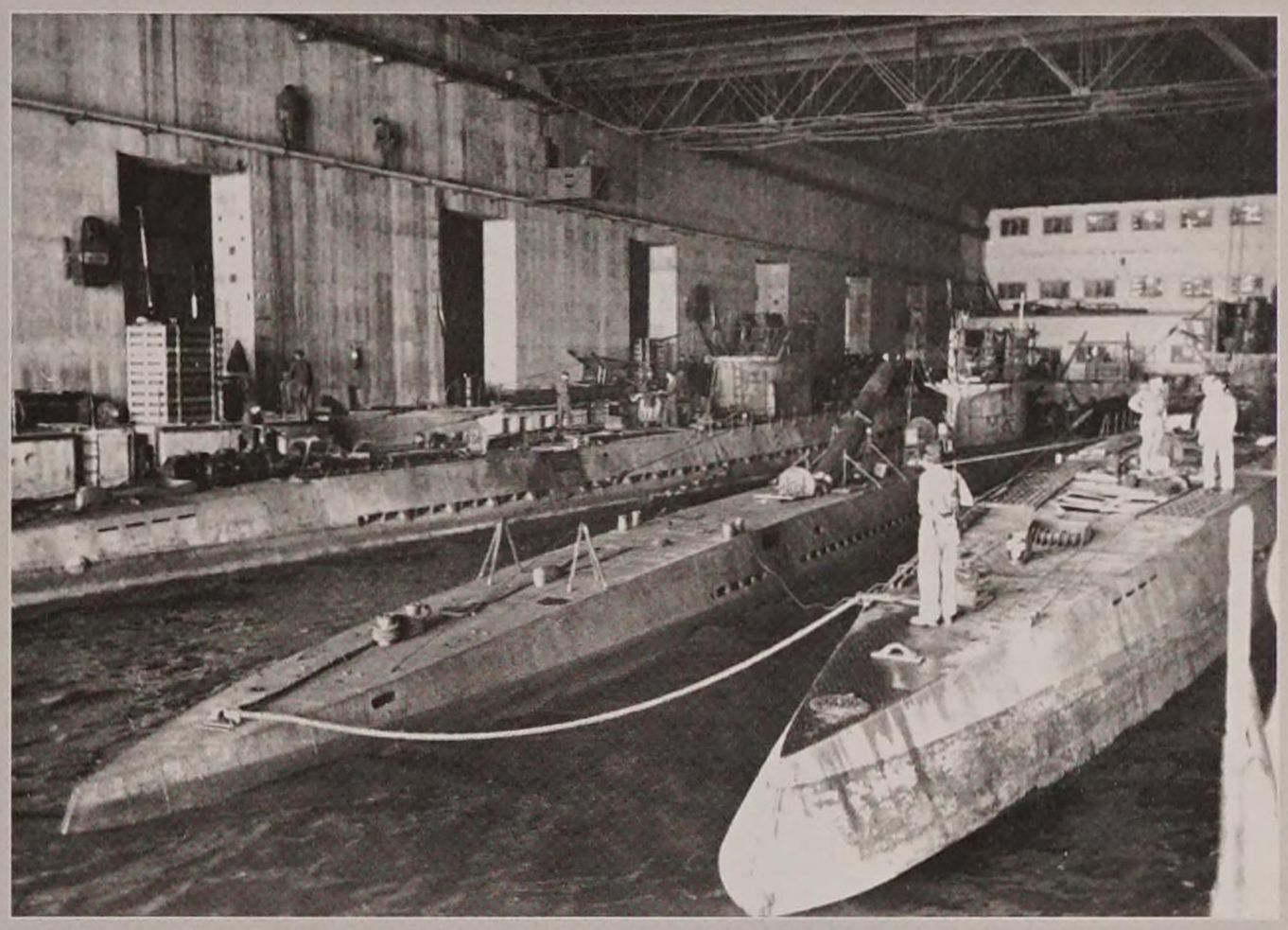
Thousands of men were also needed to repair and maintain submarines in eight German U-boat home ports, plus others under German occupation in France, Norway, Greece, Spain, Holland, Belgium and Denmark. Prisoners of war with and without the necessary maritime skills were also drafted in to work on submarines and others helped build gigantic reinforced concrete submarine pens used by U-boats based at the five Bay of Biscay ports.

The 1941 figures produced by the German Office of Naval Construction provide some idea of the manpower and resources needed to construct U-boats:

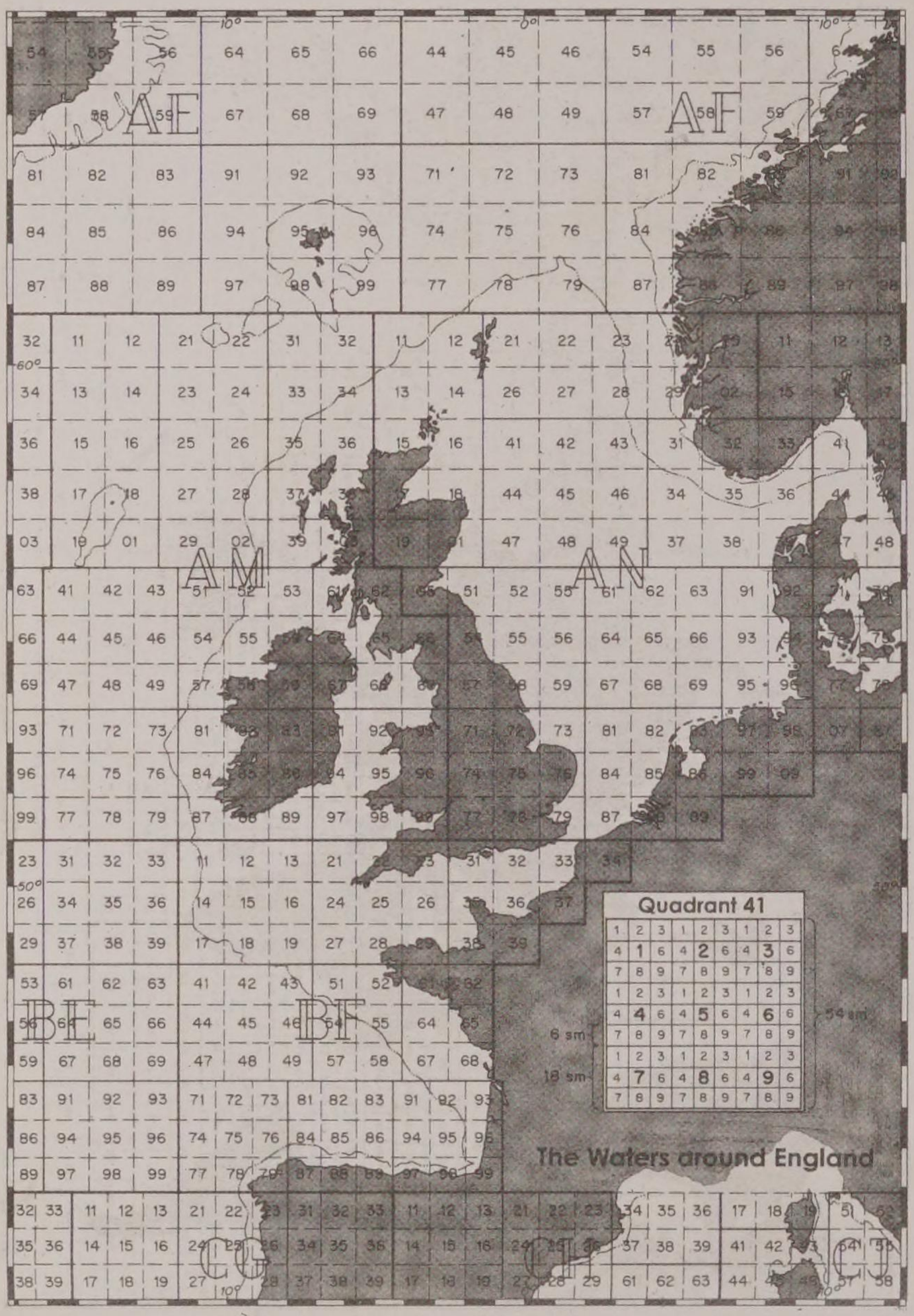
For the delivery of one Type VII submarine, some 2,400 workers are needed per month, which means 50,400 for twenty-one boats. Another 70 men minimum or 100 men maximum are needed to equip a submarine once it is built. Calculations which follow are based on an average figure of 85 workers. To equip 300 front-line boats (of which 150 will at any given time be undergoing repairs); a contingent of 85 × 150 = 12,750 workers will be needed in the shipyards. In addition, 63 workers (3 × 21) will be needed to finish and equip new boats undergoing tests and front-line training and to work on some 65 training vessels. It is estimated that some 30 of these additional boats will require repairs at any one time, which would call for 2,550 additional workers. Thus the total workforce required amounts to 50,400 + 12,750 + 2,550 = 65,700. This is a relatively modest figure, bearing in mind that some 136,000 workers, 70 per cent of them skilled, are at present employed at shipyards, now working in and outside of Germany for the Kriegsmarine.

The submarine division of the Kriegsmarine High Command argues that considering the priority status afforded to the submarine building programme with a view to prompt destruction of shipping carrying supplies to England – a destruction in which the submarine today plays and must continue to play a predominant part – the corresponding manpower must under all circumstances be made viable, particularly since conditions, in terms of raw materials and shipyard facilities, most certainly allow the present for the construction of 24–25 submarines a month. If it should emerge that the remaining 80,500 workers – together with those additional recruits to the labour force who, to a certain, if inadequate, extent have been made available on a regular basis despite the considerable prevailing difficulties and will, presumably be available in future – do not suffice to perform the remaining tasks in shipyards, it is our view that adjustments and cutbacks must first be made in these other spheres, until such time as it becomes possible to fulfil their requirements, too.

The Submarine Division of the Kriegsmarine High Command, as the department responsible for assuring the implementation of the submarine programme, considers it a duty to stage unequivocally what would be the inevitable consequences of any further cutback in the submarine building programme. Such a cutback is unacceptable. It would mean that we would have to give up using the submarine as the principal weapon in the struggle against Britain's supply lines, if not an end to the effectiveness of submarine warfare in general.



ABOVE Inside an Atlantic U-boat pen. *(Bundesarchiv)*



ABOVE Instead of using the navigational standard of latitude and longitude to denote global locations, the Kriegsmarine devised its own 'Naval Grid System'. The entire ocean area was divided into large square sectors, with each sector given a two-letter designation. Each sector was further divided into a 3 × 3 matrix, so that there were nine medium squares. These nine medium squares were again divided into nine smaller squares. This was known as a 'grid', with 81 total grid squares within a sector. Each grid was given a two-digit designation, giving the system two alphabets and two digits. For example, Grid AN79 covered the area of Dover and parts of the English Channel. Each of these grids were again divided in the same manner – first into a 3 × 3 matrix, and then each matrix was divided into nine squares, so that a further 81 squares were formed within it. Each newly formed square was again given a two-digit designation. The complete system would now read as two alphabets with four digits. This was referred to as the 'patrol zone'. Each patrol zone roughly covered an area of about 6nm². In this way, U-boats could pinpoint any location on the globe using only six characters – two alphabets for the large sector and four digits to fix the location within 6nm² in the sector. *(Thanks to www.uboataces.com for this information)*

The move to French bases gave the U-boat-Waffe further successes. –Between June and September 1940, 2.3 million tons of British and Allied shipping was destroyed. During the next six months and with U-boats operating from France, a further 2.5 million tons of merchant shipping was sunk. It was no wonder that this period was known to the Germans as the first '*Die Glückliche Zeit*' – the 'Happy Time'. The reason was thanks to Britain's lack of ships equipped with radar, making U-boats difficult to detect when they made night-time surprise attacks.

Dönitz exploited the fact that German intelligence had been able to intercept British codes, allowing them to discover where convoys would be heading and when they would reach certain points along their routes. At the same time Britain was aware that German intelligence was accurate, thanks to the superior hydrophone system used to detect ships: a method of recording or listening to underwater sounds, such as approaching surface ships, from distances of 80–100km away. Good hydrophones could also estimate the times that convoys left port, as well as how many merchant ships and escorts travelled with each convoy. This allowed U-boat headquarters to order their boats to make submerged lines at right angles to beneath where they expected convoys to pass overhead. The line might include five U-boats spaced out over a distance of 100km from end to end, which would go in for the kill together.

During the early wartime years, convoys were only escorted for the first and last 300 miles of their perilous journeys across the Atlantic because of a shortage of escort ships. Vessels that were available lacked endurance and their crews of young men, with an average age of 21, were woefully under-trained and inexperienced. It was during this time that Dönitz commented that 'ships are harder to replace than cargo and if ships can be sunk faster than they can be built, Britain will starve'.

By 1941, Canada's small navy had grown 50-fold and took up over half the burden of escorting North Atlantic convoys to British ports. The decks of their escort ships were laden with tanks and their holds loaded with food and material supplies from neutral America. But, following submarine losses in

LEFT By 1941, the Canadian Navy took up over half the burden of escorting North Atlantic convoys to British ports. Their escort ships' decks were laden with tanks and their holds loaded with food and material supplies from neutral America. But, following submarine losses in 1941 and major repairs undertaken on damaged boats, only a third of the Kriegsmarine's Atlantic-based U-boat fleet went out on patrol at any one time that year. *(National Archives of Canada)*

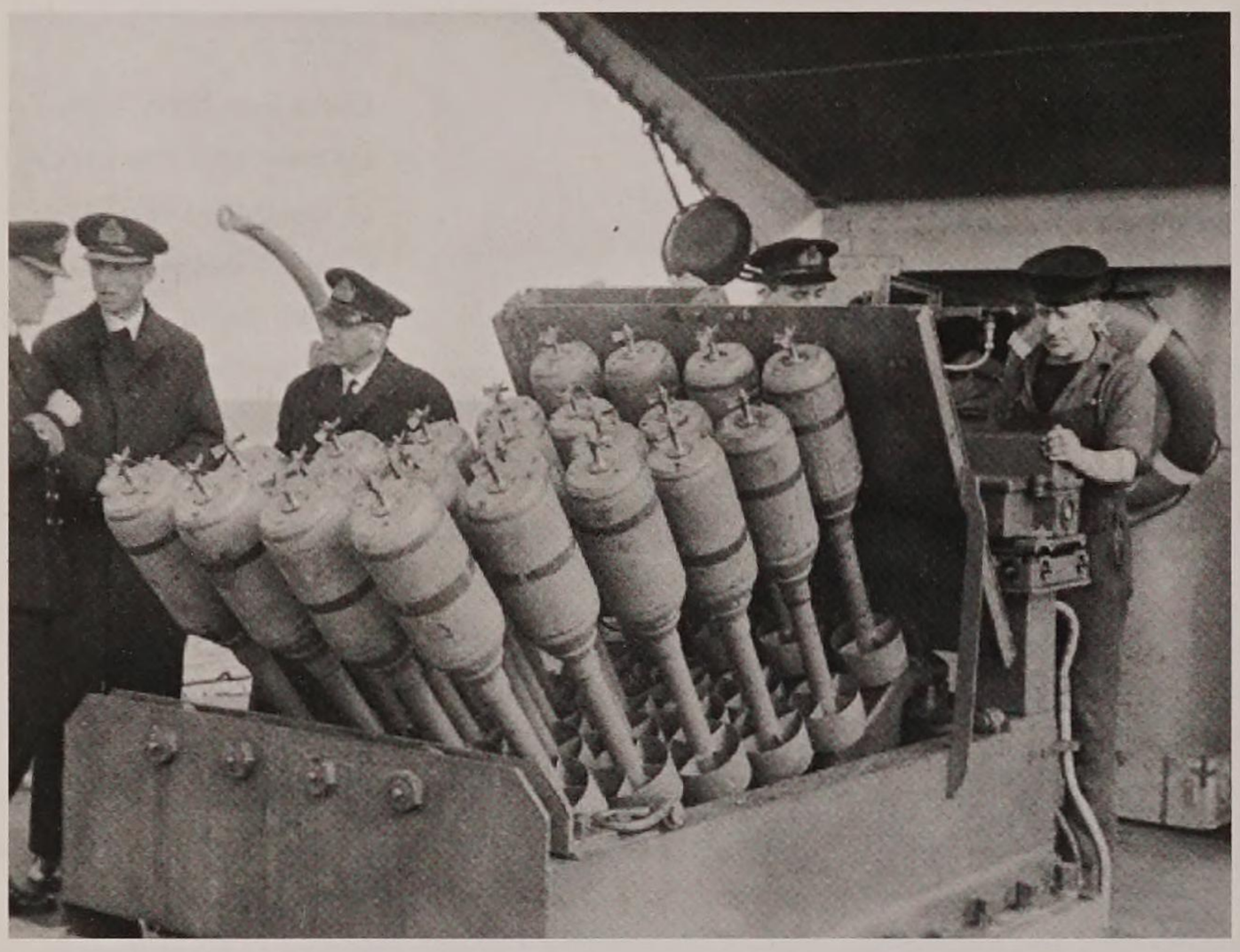
1941 and major repairs being undertaken on damaged boats, Dönitz could only send one-third of his Atlantic-based fleet on patrol at any given period. And with some of his best commanders lost at sea or taken prisoner, he could only keep six or seven submarines at sea at any one time. He remembered:

> *With this small number of U-boats, any decisive success in the Battle of the Atlantic was not possible. That's why it was necessary for submarine building to get first place in the German armament plan. But this was not done, despite all requests from Admiral Raeder, then chief of the German navy.*

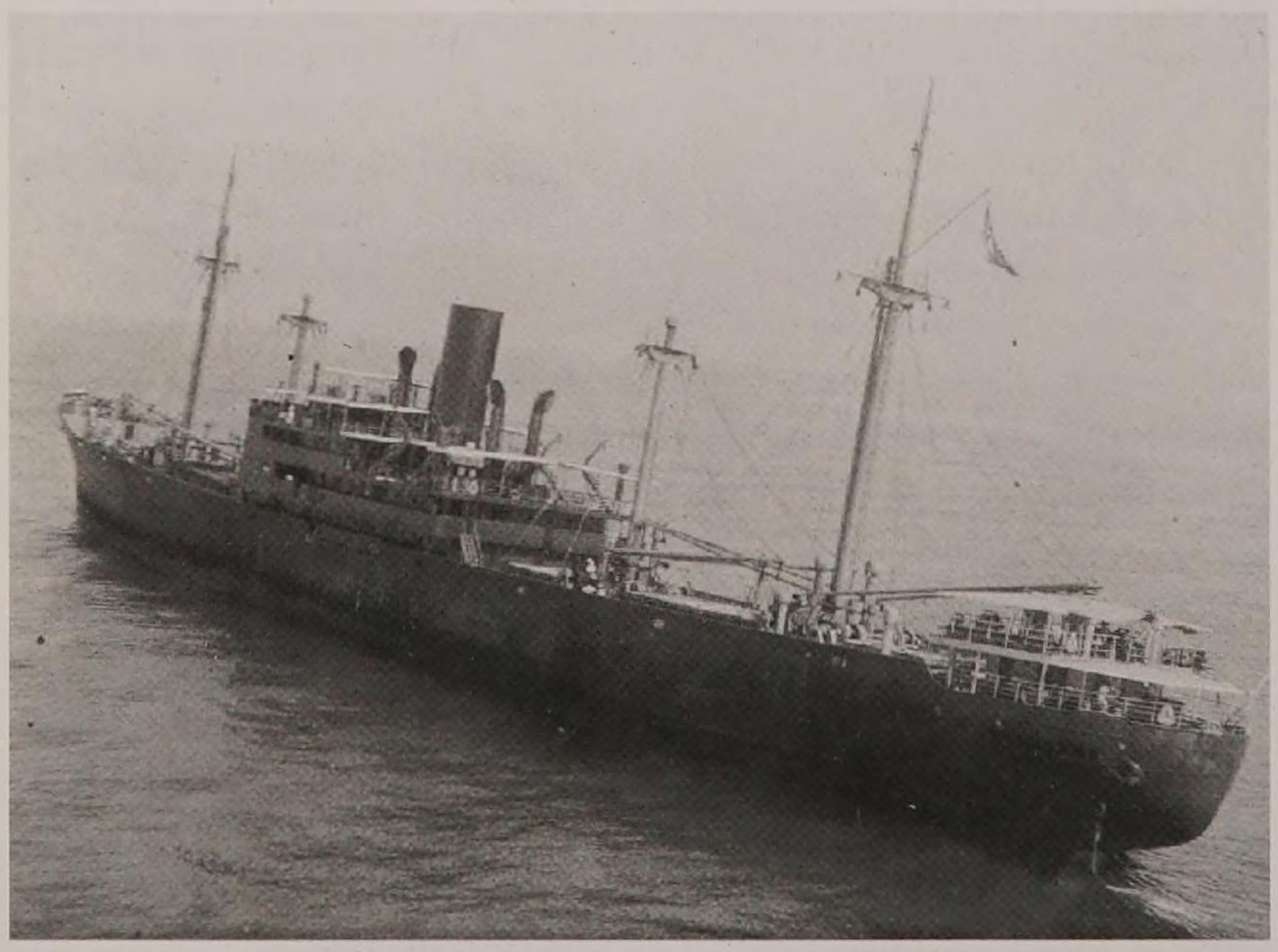
Up until December 1941 the United States was still officially neutral, but following Churchill's Atlantic meeting with President Roosevelt, America announced it would protect ships of any nationality plying the route between her shores and Iceland and would supply sufficient warships to ensure continuous escorts across the Atlantic – providing a robust counter-attack for U-boats. The US finally entered the European war on 11 December 1941, four days after the Japanese bombed Pearl Harbor. Dönitz claimed that the Pearl Harbor attack 'was a complete surprise to Germany's political and military leaders and also resulted in a state of war between the United States of America and Germany'.

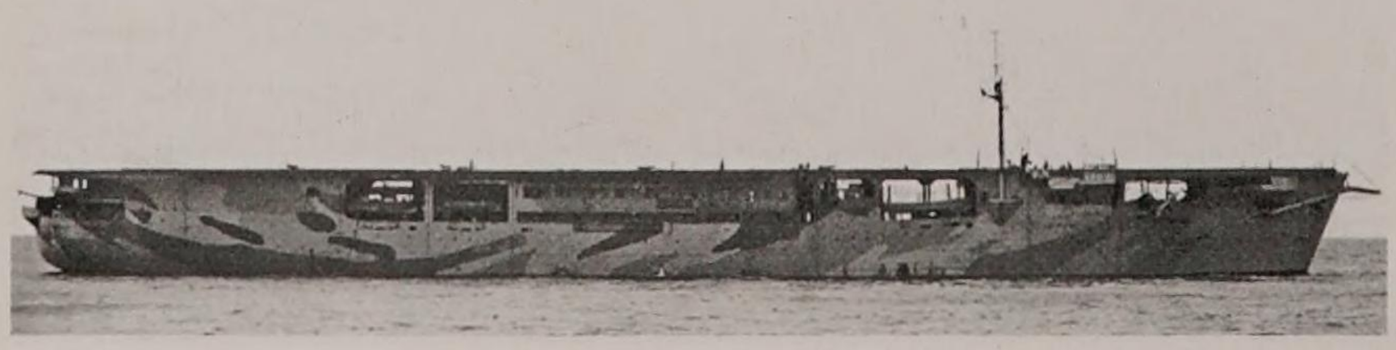
No sooner had America come to Britain's aid, U-boat Command equipped the first six U-boats to operate in US waters as close as possible to the coast. The total number of U-boats ready for service remained small and a larger monthly rate of increase was not expected before spring 1942.

BELOW Officers on the bridge of a destroyer in October 1941 escorting a large convoy. They keep a sharp lookout for attacking enemy submarines during the Battle of the Atlantic. *(The Navy League)*



ABOVE The Hedgehog (also known as an Anti-Submarine Projector) was an ahead-throwing anti-submarine weapon developed by the Royal Navy and deployed on convoy escort warships such as destroyers and corvettes to supplement the depth charge. The weapon fired a number of small spigot mortar bombs from spiked fittings, which exploded on contact. They achieved a higher sinking rate against U-boats than depth charges. The device got its nickname from the appearance of the rows of empty spigots, resembling the spines of a hedgehog. *(Imperial War Museum)*





Convoy operators devised a plan that whenever a U-boat attacked a convoy without warning, the escort would respond by either ramming the submarine or dropping depth charges over the side. On 14 December 1941, Convoy HG76 (made up of 32 Allied merchantmen, 17 convoy ships and auxiliary aircraft carrier HMS *Audacity*) assembled in Gibraltar before a voyage to Britain. The departure was reported by German agents across the bay in neutral Spain who informed Dönitz's headquarters of the convoy's composition, escort strength and departure time. The Royal Navy knew that there would be at least six U-boats waiting for them somewhere along the convoy's route, as signals had been picked up by the Admiralty. Three days out of Gibraltar, HMS *Audacity* spotted U-131 – part of the 'Sea Robber' Wolfpack – and dropped depth charges forcing the submarine to surface with poisonous chlorine gas pouring from its batteries. The submarine attempted to escape by running at full speed on the surface. While being pursued, U-131 shot down an attacking British aircraft, killing the pilot, but was itself shelled by the escort group, which scored several hits. Realising that the situation was hopeless, the crew abandoned the U-boat and scuttled her. All 47 crew survived and were taken prisoner.

Dönitz ordered five more U-boats to attack the convoy and another submarine was sunk. Desperate for a kill, the wolfpack attacked again that night. An escort and merchant ship were torpedoed and Type VIIC U-boat U-574 was rammed and destroyed. By this time some escort ships were running out of fuel and needed to return to base. As they veered out of the convoy formation, VIIC class U-751 slipped into their place sending three torpedoes into

LEFT HMS *Audacity* – part of convoy HG76 – was originally built in 1939 as a German ship named *Hannover* for North German Lloyd, Bremen. In March 1940 she was captured at sea by the Royal Navy off Dominica and renamed *Audacity*. In 1941 she was converted into an escort carrier before being torpedoed and sunk by U-751 500 miles west of Cape Finisterre. *(National Archives – Admiralty Archives)*

the direction of HMS *Audacity*, sinking the ship. Ironically, HMS *Audacity* was originally built in 1939 as a German ship named *Hannover* for North German Lloyd, Bremen. In March 1940 she was captured at sea by the Royal Navy off Dominica and renamed *Audacity* by the Ministry of War Transport. In 1941 she was given over to Blyth Shipbuilding Ltd for conversion to an escort carrier before being torpedoed and sunk some 500 miles west of Cape Finisterre.

The next morning an RAF Liberator aircraft appeared in the skies over the convoy to attack the wolfpack. Dönitz ordered his U-boats to withdraw. Five U-boats had been sunk, plus HMS *Audacity* and three other ships. The safe arrival of 30 ships and destruction of 5 U-boats was judged to be 'an outstanding victory'. By contrast Dönitz and his U-boat arm were shaken by their losses – but the admiral was about to be handed his greatest opportunity yet.

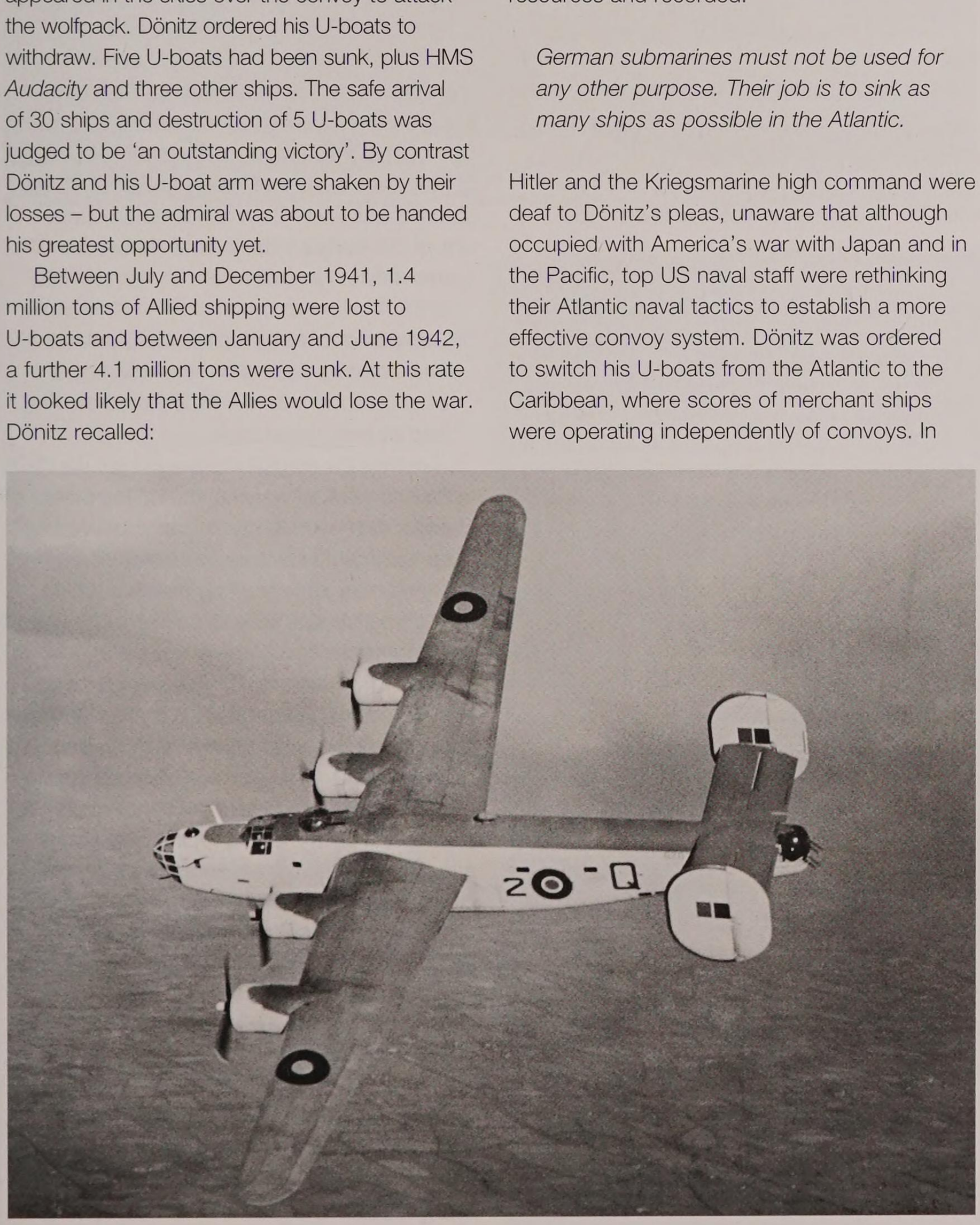
Between July and December 1941, 1.4 million tons of Allied shipping were lost to U-boats and between January and June 1942, a further 4.1 million tons were sunk. At this rate it looked likely that the Allies would lose the war. Dönitz recalled:

> *We had to sink as many ships as possible before our Anglo-American opponents could develop effective anti-submarine defences and replace merchant ships already sunk.*

But at this time Dönitz's U-boats were no longer in the Atlantic – they had been repositioned to the Mediterranean and Norway to defend Germany's supply lines. Dönitz was infuriated by what he considered a waste of his U-boat resources and recorded:

> *German submarines must not be used for any other purpose. Their job is to sink as many ships as possible in the Atlantic.*

Hitler and the Kriegsmarine high command were deaf to Dönitz's pleas, unaware that although occupied with America's war with Japan and in the Pacific, top US naval staff were rethinking their Atlantic naval tactics to establish a more effective convoy system. Dönitz was ordered to switch his U-boats from the Atlantic to the Caribbean, where scores of merchant ships were operating independently of convoys. In



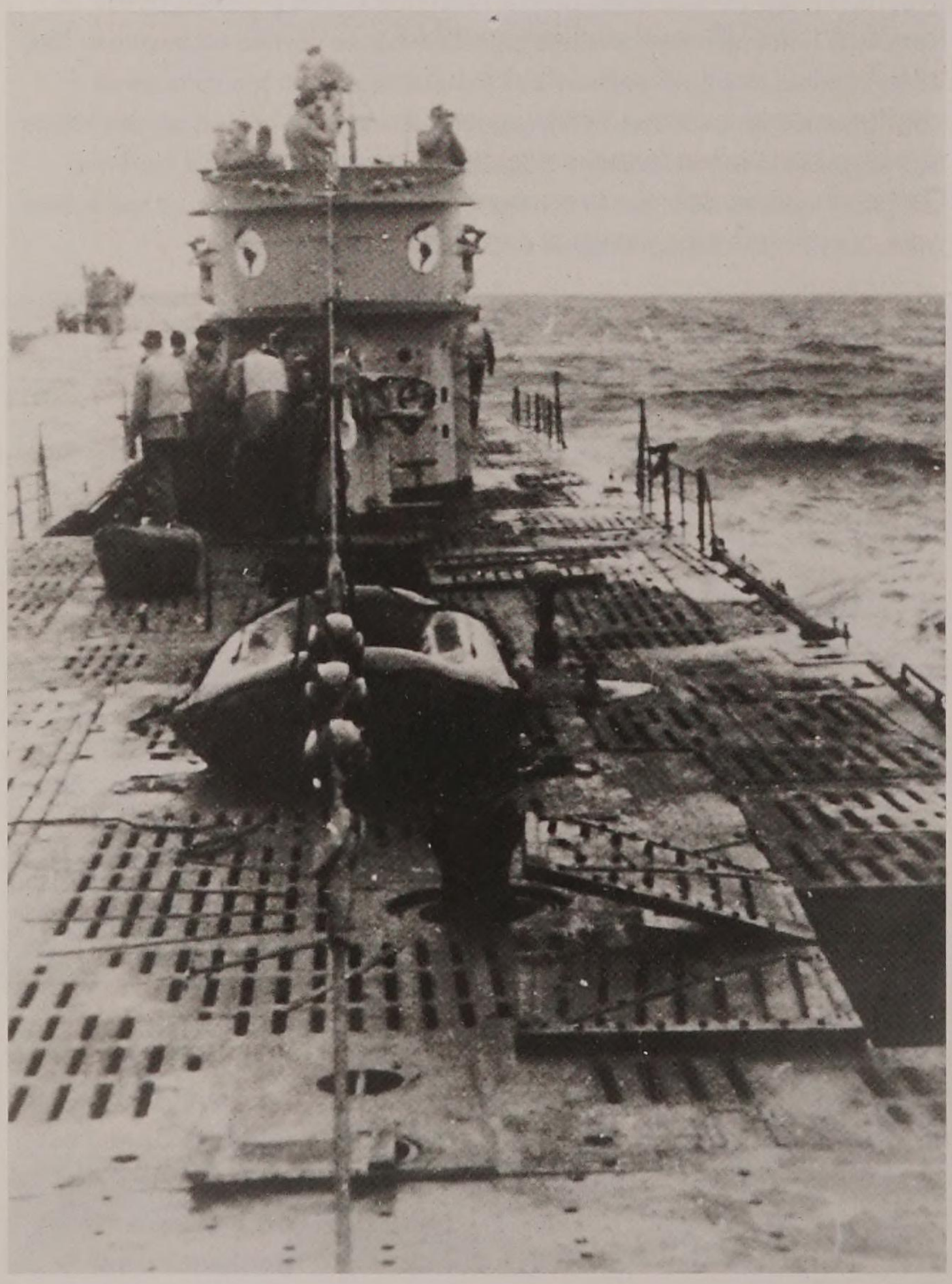
LEFT U-boat killer – a long-range Liberator GRVI of 59 Squadron RAF Coastal Command, flying out to the Atlantic from its base at Ballykelly in Northern Ireland.

two months, nearly 80 ships were destroyed – over half of them oil tankers.

When the United States officially entered the war in December 1941, she had forgotten to switch her peacetime lights off at home. Thanks to this oversight, Dönitz's U-boat men were about to experience their second 'Happy Time' (code named Operation *Paukenschlag* or Operation Drumbeat) – but known by U-boat commanders as 'the American shooting season'.

Dönitz viewed America's entry into the war as a golden opportunity to strike heavy blows in his tonnage war. Because Type VII class boats had insufficient range to patrol off the coast of North America, the only suitable vessels on hand were larger Type IX boats. However, these were less manoeuvrable and slower to submerge, making them more vulnerable than the Type VIIs. The Kriegsmarine also had fewer Type IXs than VII class boats. So Type VII U-boats were called on to cross the Atlantic, along with modified versions of the Type IXD – known as the Type XIV – designed to resupply U-boats on long patrols with fuel and food. These were nicknamed '*Milchkühe*' (milk cows). Thanks to their larger size, Type XIV boats carried and resupplied Type VII boats from their stores of up to 432 tons of fuel, four extra torpedoes and fresh food preserved in refrigeration units. They had no torpedo tubes or deck guns of their own, only anti-aircraft guns.

BELOW U-460, a Type XIV '*Milchkühe*' (milk cow) supply boat used to transport food and fuel to other U-boats at sea on long patrols.

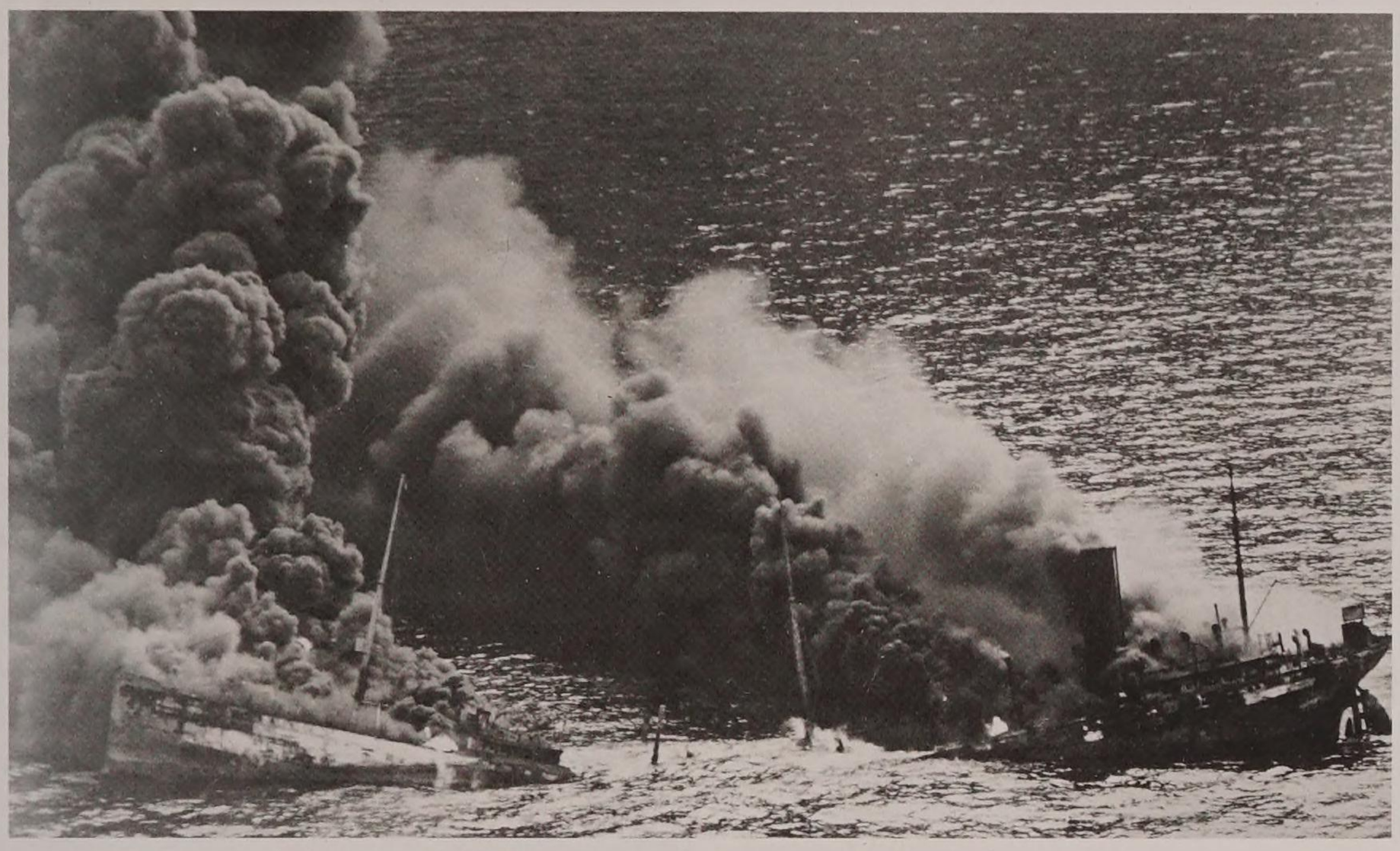


The last thing Americans were expecting was to be attacked by German U-boats in their own home harbours and sea lanes. The slaughter began on 13 January 1942 and after fighting the British for two years in the Atlantic, U-boat men found that taking America by surprise was easy. Commander Erich Topp, one of Germany's most successful U-boat commanders, remembered:

> *Compared to the difficulties in the Atlantic war, planning attacks on American ships close to shore was like shooting hares. We had an easy game there.*

In the first week of war with the United States, U-boats destroyed ten American ships. At one stage they came so close to the American shore off New York that they reported looking through periscopes at night and seeing headlights from cars passing along busy expressways leading to the Brooklyn Bridge. Finding their way close to cities and naval bases along the eastern seaboard presented no problems to U-boat crews. Each submarine was armed with a top secret and highly detailed atlas showing American shipping lanes, ports and tidal information, which made it easy for crews to plan raids on specific areas where the wolfpacks were guaranteed to find merchant ships plying their way through busy sea lanes. And find them they did. Dönitz recalled:

> *The American defence was inexperienced; on the other hand, U-boat commanders were exceptionally experienced. It was possible to operate very near to the coast and on the surface. Traffic was heavy here; consequently the results were great. The U-boat command,*



LEFT The unarmed and unescorted 8,046-ton steam tanker *Dixie Arrow* is seen here after being torpedoed by Type VIIC U-71 on 26 March 1942, 12 miles off the Diamond Shoals Light Buoy, North Carolina. The tanker took two hours to sink and out of its crew complement of 33 men, 11 died and 22 survived. U-71 sank a total of five ships from the British, US and Norwegian navies amounting to 38,894grt. *(Library of Congress)*

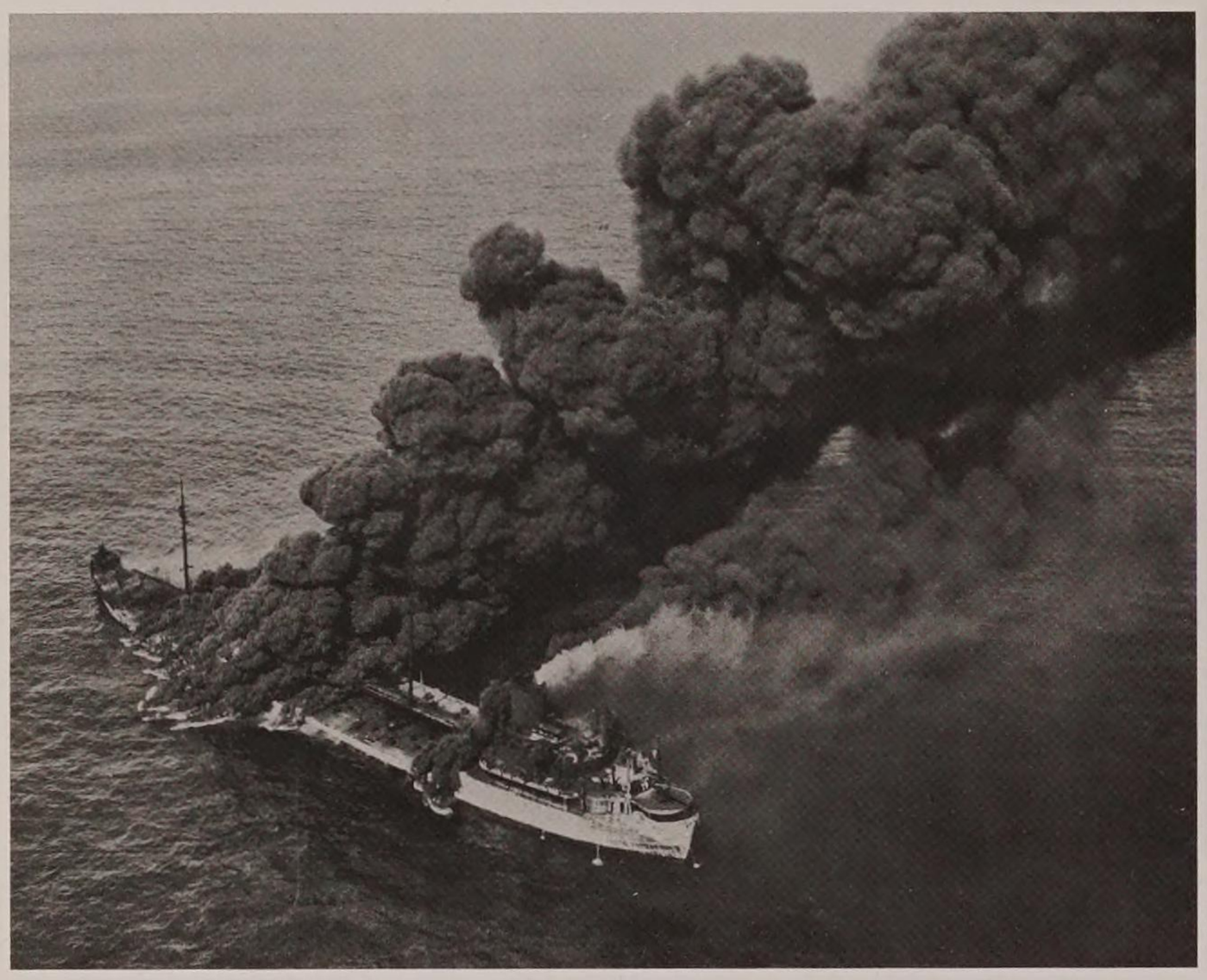
therefore, sent every boat available for operations in American waters to this area in order to profit by the favourable situation, but a reduction in these great successes was expected to set in after a few months. Such, however, was not the case.

Although the US was completely unprepared for the invasion, it assured citizens that it had the U-boat menace firmly under control. The US government produced navy enlistment posters showing a burly US sailor hauling up a depth charge and proclaiming: 'Sub spotted – let 'em have it.' In reality, the Americans had not sunk a single submarine since they had entered the war and by 1942, despite assurance to the contrary, U-boats in American waters were unstoppable as they stalked the country's eastern seaboard looking for more merchant ships to attack.

Despite the U-boat threat, American merchant vessels continued to journey up and down the coast, navigational lights blazing and their radios left open, making it easy for U-boats to locate their targets. In all, U-boats attacked and sank over 400

$90 Killed this U-BOAT!
JUNE 28th to JULY 31st
"STAMP OUT THE U-BOAT"
with extra purchases of
WAR SAVINGS STAMPS
OBJECTIVE $1,350,000 TO BUY 15,000 DEPTH CHARGES
EVERY DOLLAR INVESTED IN WAR SAVINGS STAMPS IN JULY WILL BE SPENT FOR DEPTH CHARGES. WE MUST BACK UP OUR FIGHTING NAVY TO THE LIMIT IN THE WAR AGAINST THE SUBMARINE MENACE.
Hon. J. L. ILSLEY, Minister of Finance

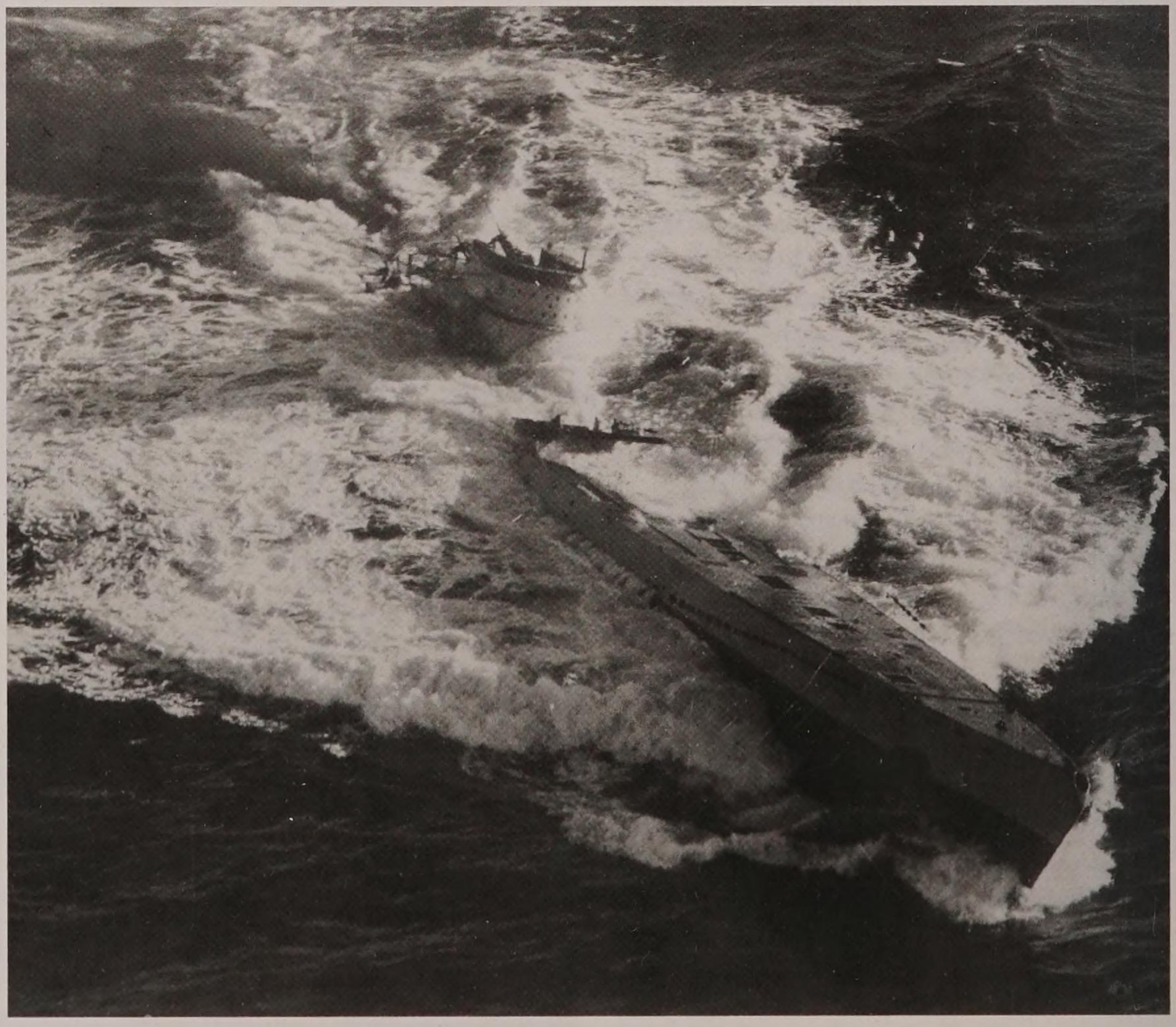
RIGHT In 1943 Canada appealed to its public to buy war savings stamps. The proceeds from these would fund depth charges to fend off Nazi U-boats. *(Library of Congress)*



ABOVE American oil tanker SS *Pennsylvania Sun* was torpedoed by Type VIIC boat U-571 on 15 July 1942 200km west of Key West, Florida. The tanker was later salvaged and returned to service. *(Library of Congress)*

DISASTER
BROADCAST RECEIVERS
CAN HELP THE ENEMY SINK YOU
Don't Use Them!
WPA · THIRTEENTH NAVAL DISTRICT · UNITED STATES NAVY ·

ABOVE A poster for the 13th US Naval District showing Japanese and German submarines and planes targeting a ship on the horizon. *(Library of Congress)*



RIGHT U-185 sinking on 11 August 1943 after being bombed by US carrier-borne aircraft south-west of the Azores. More than 40 men managed to reach the deck and jump into the sea as their boat sank. Some 36 men were later rescued by destroyer USS *Barker*, the rest succumbing to wounds or chlorine poisoning. The survivors spent the following three years as prisoners of war before returning to Germany.

American ships – the largest single defeat the US Navy had ever suffered.

But Dönitz and the German political elite underestimated the power and resources of the United States and by May 1943 – known to U-boat men as '*Schwarz Kann*' or 'Black May' – 41 U-boats had been destroyed. U-boat losses, which previously had been 13% of all boats lost at sea, rose rapidly to 30% and then 50%. A crisis in morale entered the U-boat-Waffe as the realisation dawned that they were now outnumbered by the enemy. Losses were not only suffered in convoy attacks but everywhere else at sea. There was no part of the Atlantic where U-boats were now safe from being spotted by aircraft operating day and night. All U-boat entrance and exit channels in the Bay of Biscay were, in particular, most carefully watched. Losses here were especially high. Dönitz wrote:

> *Under these circumstances, the previous surface war on convoys could not be continued because, in the meantime, the favourable conditions in the American sphere of activity had also changed and U-boat successes had diminished considerably in that theatre.*

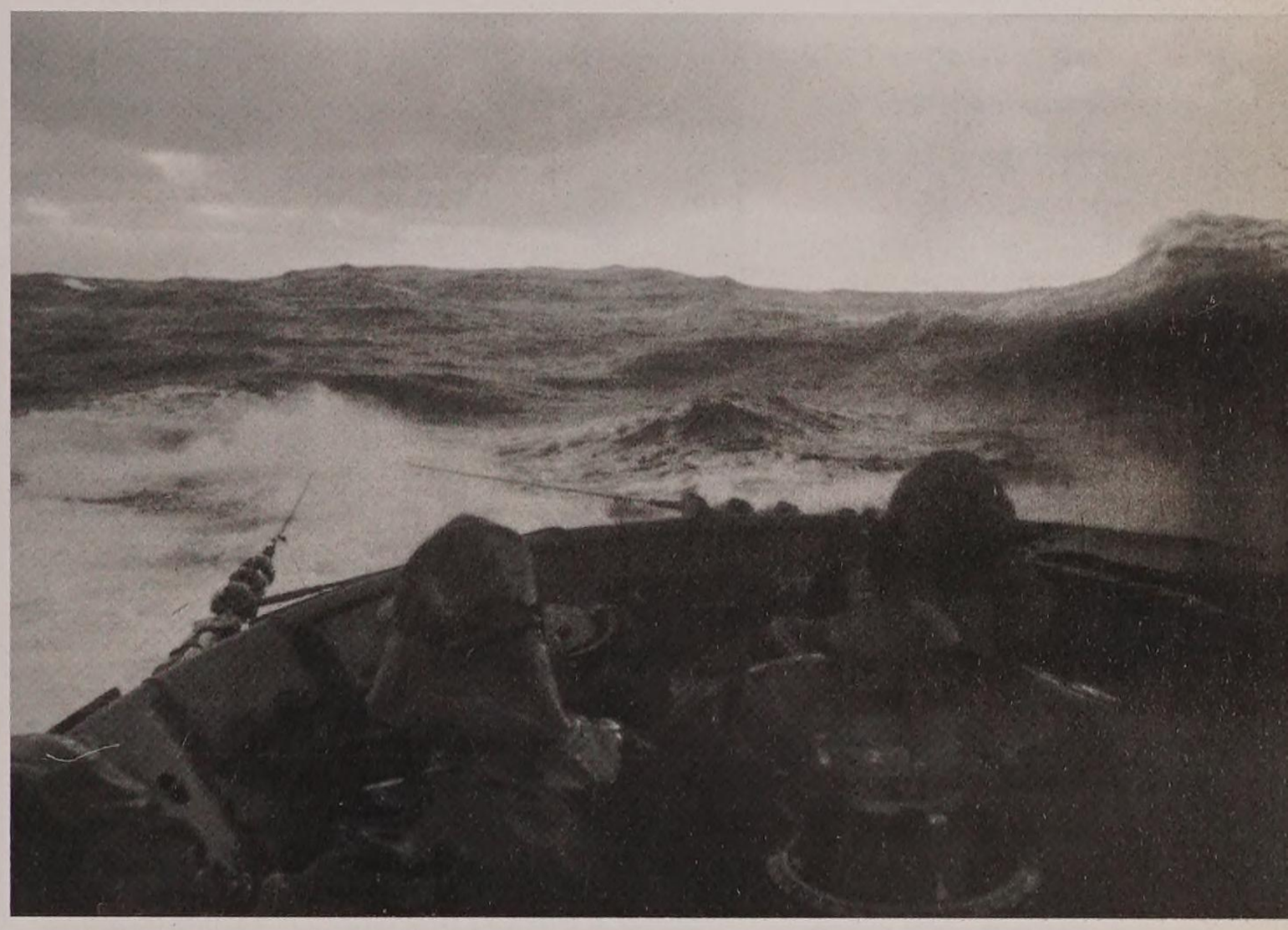
The loss of Bay of Biscay ports as operational bases disadvantaged Dönitz's U-boat war. Land communications to the ports were severed by advancing Anglo-American armies removing the chance of sourcing further fuel supplies and torpedoes. Despite favourable opportunities for attacks close to the English coast, there was only a modest increase in sinkings due to the dwindling number of U-boats available, which by now numbered just 13 operational vessels.

Towards the end of 1943, remaining U-boats were forced to spend at least 4 out of every 24 hours on the surface recharging their batteries. The presence of so many Allied aircraft in the skies made it dangerous for any U-boat to spend too much time above water. Thanks to radar, U-boats could now be detected at any hour in daylight, darkness, fog or smokescreen.

In January 1943 Roosevelt and Churchill had declared that defeating all remaining German U-boats should be given priority. Improved escort vessels armed with radar were introduced and there were always enough of them to attack whenever a U-boat appeared. But that same month Dönitz took over as chief of the entire Kriegsmarine following Raeder's resignation after a dispute with Hitler. Dönitz became Commander-in-Chief of both the Kriegsmarine as well as C-in-C of U-boats. He paid off most of Germany's big ships and transferred their crews into the submarine service. At last he could mass-produce his U-boats and production was stepped up to 17 new boats monthly – which was still insufficient for Dönitz's needs.

Despite earlier losses, by May 1943 the US Navy was escorting ships carrying over 150,000 American troops across the Atlantic and not a single vessel was lost. At the start, Operation Drumbeat had been one of the Kriegsmarine's greatest victories, but it had failed to knock America out of the war. For Americans the U-boat was never an 'Atlantic Pearl Harbor'. Although U-boats continued to attack American shipping until the last day of the war, when single submarines still ran up to America's doorstep like lone wolves on the prowl, it finally ended in surrender and defeat, and for the U-boat crews, long spells as prisoners of war. The happy times were now over.

By June 1943 the number of Allied ships lost to U-boats in the Atlantic had fallen dramatically. In May that year, 41 U-boats were sunk. In one of them was Leutnant Peter Dönitz, the Grand



ABOVE On the bridge of Type VII boat U-402 in heavy North Atlantic seas during 1942. Under the command of *Korvettenkapitän* Siegfried Freiherr von Forstner, Knight's Cross, U-402 sank 15 ships totalling 71,036grt before she herself was sunk in mid-Atlantic by aircraft from USS *Card* on 13 October 1943, all hands being lost. *(Bundesarchiv)*

Admiral's youngest son, killed while serving as a watch officer on Type VIIC boat U-954 when the boat was sunk with all hands in the North Atlantic. Following this, Dönitz's older son, Klaus, was permitted to withdraw from combat duties to train as a naval doctor. Klaus, however, kept in touch with former U-boat comrades and on his 24th birthday – 13 May 1944 – he convinced friends to take him along on torpedo boat S-141 for an attack on the English south coast. The vessel was destroyed and six crew members were rescued. Klaus Dönitz was not among them.

Reflecting on the final days of the U-boat war, Dönitz wrote:

> *In May 1943, German submarines had lost the operational and tactical qualities of surface manoeuvrability. . . . By the autumn of 1944 the war situation in all theatres and on all fronts had an extremely grave appearance. After losing the greatest part of territories previously occupied by us in the west, south and east, 'Fortress Europe' had been reduced to 'Fortress Germany'.*

The Kriegsmarine never regained its former strength and power at sea. Unable to freely roam the seas for their prey, the wolfpacks were finally beaten. New submarines produced for Dönitz's U-boat arm – Types XXIII and XXI vessels – expected to alter the course of the war at sea, were delivered too late to make any difference. The bombing of German submarine factories by the RAF made sure of that. Hopes were high that new boats would re-establish Germany's position as the world's premier sea hunters, but from the winter of 1944 until the end of the war, more U-boats on German production lines were lost to bombing than lost at sea. The planned new effectiveness of the German U-boat war was, therefore, cut short by the country's capitulation.

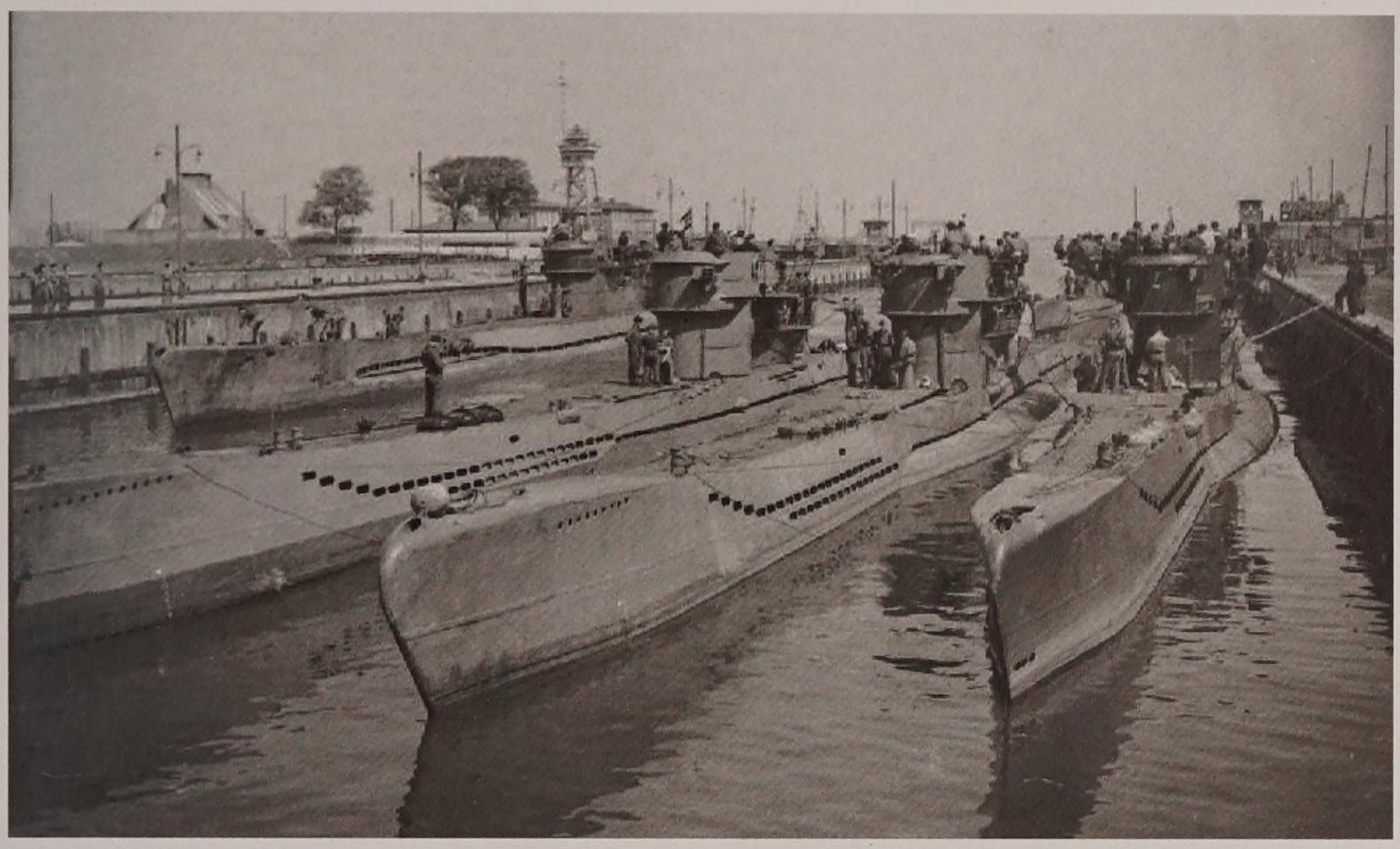
And so the battle of the U-boats came to an end with a directive from the German high command informing submarine commanders still out on patrol that Germany had surrendered unconditionally and a ceasefire was ordered from 22.01 hours GMT on 8 May 1945. All U-boats were instructed to:

a) Remain on the surface flying a large black or blue flag by day and burning navigation lights at night.
b) Make for specific ports under Allied control.
c) Report their position in plain language every eight hours.

From his prison cell awaiting trial for war crimes, Dönitz remembered his U-boat crews by writing:

> *Self-sacrificing and courageous, unstained and honourable had been the conduct of crews in battle . . . their successes were unique. According to enemy figures, more than 2,000 ships of at least 14 million tons, including numerous escort vessels, destroyers and cruisers, aircraft and battleships were sunk. Many other naval and merchant vessels were damaged. . . . The German navy had fought honourably and courageously, afloat and ashore, on all seven seas and in all European theatres of war. The fighting spirit and high idealism which inspired both officers and men remained unbroken to the bitter end. No stain sullied the German ensign when it was hauled down, with honour, after a lost war.*

RIGHT An aerial photo taken from a Short Sunderland Mark III of No 10 Squadron RAAF during an attack on Type VIIC submarine U-426. The attack took place west of Nantes in the Bay of Biscay on 8 January 1944. The crew of 51 all perished. *(Australian War Memorial Archive)*



LEFT U-boats in the lock at Wilhemshaven before entering the harbour to surrender. *(Imperial War Museum)*

Winston Churchill wrote in his memoirs:

> *The U-boats were choked on the very seas in which they sought to choke us . . . and once again with shining weapons, we swept the approaches to the isle.*

In reality the U-boat war was a failure. Germany sank only a small percentage of all Allied shipping, while the remainder got through safely to their destinations. But the U-boat threat tied down Allied resources in the Atlantic. Hitler told his U-boat crews: 'You are my first line of defence in keeping the enemy at arm's length while I fight my war in Russia.'

To satisfy the demands of Hitler and Dönitz, U-boat crews were sacrificed. In the closing months of the war, the life expectancy of a U-boat crewman was barely 60 days. But the Kriegsmarine kept sending their young men – of average age 18–22 – to their deaths. The U-boat service lost 38,000 men while 5,000 were taken prisoner out of a total force of 48,000 men. No branch of an armed force has ever sustained those same losses and remained operational. In the last months of the war only two out of every ten U-boats leaving port were expected to return. Tragically, most of those U-boats lost at sea carried young seamen going out on their first patrol.

The final merchant vessel to be sunk by a U-boat fell victim on 7 May 1945, when Type XXIII submarine U-2336 torpedoed the last ship before the German surrender. Many claimed that other U-boats had escaped across the Atlantic carrying fleeing senior Nazis. Others said that some U-boats had escaped carrying gold bullion, precious art treasures, foreign currency and other loot. It makes a good story, but is untrue as all U-boats were accounted for, although some were lost through unknown causes before the surrender.

BELOW A Liberator from No 59 Squadron circles Type VIIC/41 U-293 commanded by *Kapitänleutnan*t Leonard Klingspor off the Hebrides. The submarine was flying the black flag of surrender and given over to the Royal Navy at Loch Eriboll, Scotland, on 11 May 1945. *(The Navy League, June 1945)*

OPERATION DEADLIGHT

Operation Deadlight was the code name for the Royal Navy's plan to scuttle German U-boats surrendered to the Allies following Germany's 1945 defeat.

Of the 156 U-boats that surrendered, 116 were scuttled as part of Operation Deadlight. The operation was carried out by the Royal Navy, which planned to tow the defeated submarine flotilla to three areas 100 miles north-west of Ireland and sink them. Areas were code named XX, YY and ZZ. XX was to be the main scuttling area, while 36 boats would be towed to ZZ for use as targets for aerial attack and YY as a reserve position where submarines could

LEFT Type VIIC/41 boat U-1009 surrendered at Loch Eriboll and is pictured here arriving at the Port of Londonderry at Lisahally in County Londonderry, Northern Ireland – the UK's most westerly port – prior to being sunk. Note the stowed snorkel mast gear in the deck casing in the foreground. *(The Navy League)*

BELOW Six U-boats moored to the jetty at Lisahally. Their identification numbers and conning tower motifs have all been painted over. *(Through Their Eyes)*

RIGHT Downcast U-boat crew surrender their vessel at Loch Eriboll, Scotland, on 10 May 1945. Over 30 U-boats, including U-532 and U-295, formally surrendered at this 6km-long sea loch on Scotland's north coast before being towed across the Irish Sea to three different areas to be sunk. Loch Eriboll was chosen for the surrender because it was – and remains – one of Scotland's most remote places, away from the main centres of population. *(Through Their Eyes)*

be diverted from XX to be sunk by naval forces. In the case of submarines not being used as targets, the plan was to sink them via explosive charges with naval gunfire as a fall-back option if that failed.

When Operation Deadlight was activated, it was found that many U-boats were in poor condition after being moored in exposed harbours awaiting disposal. Combined with inclement weather, this meant that 56 boats sank before reaching designated scuttling areas and those which did were sunk by gunfire rather than explosive charges. The first sinking took place on 17 November 1945 and the last on 11 February 1946.

But some U-boats escaped Operation Deadlight. Some were claimed as prizes by Britain, France, Norway and the Soviet Union. Four were in the Far East when Germany surrendered and were commandeered by Japan. Another two U-boats are today museum ships. U-505 was earmarked for scuttling but US Navy Rear Admiral Daniel V. Gallery argued successfully that she did not fall under Operation Deadlight. Under Gallery, United States Navy Task Group had captured U-505 in battle on 4 June 1944. Having been captured and not surrendered at the close of war, she survived to become a tourist attraction at Chicago's Museum of Science and Industry.

U-995 was transferred to Norway by Britain in October 1948 and in 1952 became the Norwegian coastal defence vessel and training submarine RNS *Kaura*. She was returned to Germany in 1965, was renamed U-995 and became a museum ship on permanent display at the Deutscher Marinebund memorial at the Baltic seaside resort of Laboe, near Kiel.

BELOW U-boat prisoners at Lisahally bound for prison camps on the British mainland. By the end of 1945 over 400,000 German prisoners of war were held in Britain. Clement Attlee's post-war government ignored the Geneva Convention by refusing to allow German prisoners to return home until well after the war was over. By 1946, up to a fifth of all farm work in Britain was being carried out by German prisoners who were also employed on road works and building sites. Fraternisation between prisoners and local people was forbidden and repatriation progressed slowly. The fraternisation ban was lifted in time for Christmas 1946. In towns across Britain many people chose to put the war behind them by inviting German prisoners to join them for a family Christmas – the first these men had experienced in years. *(Through Their Eyes)*

Stb

HAGENUK
KIEL

Äuß.Kraft
Große Fahrt
Halbe Fahrt
Langs.Fahrt
Kleine Fahrt
Dieselmotor
Achtung
Stopp
E-Maschinen
Beide Maschinen
10 weniger
Laden
Kleine Fahrt
Langs.Fahrt
Halbe Fahrt
Äuß.Kraft

VORAUS
ZURÜCK

Chapter Three

Anatomy of the Type VII class

The Type VII was the most numerous German U-boat class of the Second World War with 709 built and the most produced submarine class in history. It was based on earlier German submarine designs that dated from the First World War with the original version designed through the bogus Dutch company Ingenieurskantoor voor Scheepsbouw den Haag (I.v.S), set up by Germany to maintain and develop German submarine technology and circumvent limitations set by the Treaty of Versailles.

OPPOSITE Motor room starboard engine telegraph.

Type VII class U-boats: technical specifications

	Type VIIA	Type VIIB	Type VIIC	
Role	Attack U-boat	Attack U-boat	Attack U-boat	
Displacement				
Surfaced	626 tons	753 tons	769 tons	
Submerged	745 tons	857 tons	885 tons	
Dimensions				
Length	211.6ft (64.5m)	218.2ft (66.5m)	220.1ft (67.1m)	
Beam (overall)	19.0ft (5.8m)	20.3ft (6.2m)	20.3ft (6.2m)	
Draught	14.4ft (4.4m)	15.4ft (4.7m)	15.7ft (4.8m)	
Top speed				
Surfaced	16.0 knots	17.2 knots	17.2 knots	
Submerged	8.0 knots	8.0 knots	7.6 knots	
Maximum range				
Surfaced at 12 knots	4,300nm	6,500nm	6,500nm	
Submerged at 4 knots	90nm	90nm	80nm	
Crush depth	656ft (200m)	656ft (200m)	656ft (200m)	
Weapons				
Bow tubes	4 × 21in	4 × 21in	4 × 21in	
Stern tubes	1 × 21in	1 × 21in	1 × 21in	
Torpedo capacity	11	14	14	
Mines	22 TMA or 33 TMB	26 TMA or 39 TMB	26 TMA or 39 TMB	
Guns	1 × 88mm cannon 1 × 20mm AA cannon	1 × 88mm cannon 1 × 20mm AA cannon	1 × 88mm cannon 1 × 20mm AA cannon	
Crew	44–52 officers, NCOs and ratings	44–52 officers, NCOs and ratings	44–52 officers, NCOs and ratings	
Total built	10	24	571	
First launch	24 June 1936	27 April 1938	19 September 1940	

Other average dimensions and capabilities of Type VII class U-boats:

Height:	
Upper deck above keel	6.0m
Top of conning tower above keel	9.39m
Top of attack periscope above conning tower fairing	5.26m
Top of search periscope above conning tower fairing	2.60m
Extended attack periscope above keel	14.66m
Extended air search periscope above keel	11.99m

	Type VIIC/41	Type VIIC/42	Type VIID	Type VIIF
	Attack U-boat	Attack U-boat	Minelayer	Torpedo supply
	769 tons 871 tons	999 tons 1,099 tons	965 tons 1,099 tons	1,084 tons 1,181 tons
	165ft 8in (50.5m) 20ft 4in (6.2m) 15ft 6in (4.72m)	225.4ft (68.7m) 22.6ft (6.9m) 16.7ft (5.1m)	252.3ft (76.9m) 21.0ft (6.4m) 16.4ft (5.0m)	254.6ft (77.6m) 24.0ft (7.3m) 16.1ft (4.9m)
	17.0 knots 7.6 knots	18.6 knots 7.6 knots	16.0 knots 7.3 knots	16.9 knots 7.9 knots
	8,190nm 130nm	10,000nm 80nm	8,100nm 69nm	9,500nm 75nm
	820–970ft (250–300m)	656ft (200m)	656ft (200m)	656ft (200m)
	4 × 21in 1 × 21in 12 26 TMA or 39 TMB 1 × 3.7cm AA cannon 2 × 2.2cm AA cannon	4 × 21in 1 × 21in 16 26 TMA or 39 TMB 1 × 88mm cannon 1 × 20mm Twin Flak 1 × 20mm Quad Flak	4 × 21in 1 × 21in 14 15 SMA 1 × 88mm cannon 1 × 20mm Flak	4 × 21in 1 × 21in 14 + 27 26 TMA or 39 TMB 1 × 88mm cannon 1 × 20mm Flak
	44–52 officers, NCOs and ratings	45	44	46
	88	(cancelled in September 1943 in favour of Type XXI Electro Boat)	6	4
	17 July 1943		24 July 1941	12 March 1943

Conning tower and keel:

Height of conning tower above pressure hull	2.63m
Length of conning tower	2.95m
Width of conning tower	1.76m
Height of keel	0.55m
Width of keel	1.10m
Length of straight keel	32.35m

Propulsion:

2 × supercharged 6-cylinder diesel engines totalling 2,800–3,200hp (2,100–2,400kW) surfaced; 2 × BBC electric motors, totalling 750hp (560kW) with a maximum rpm of 296 submerged.

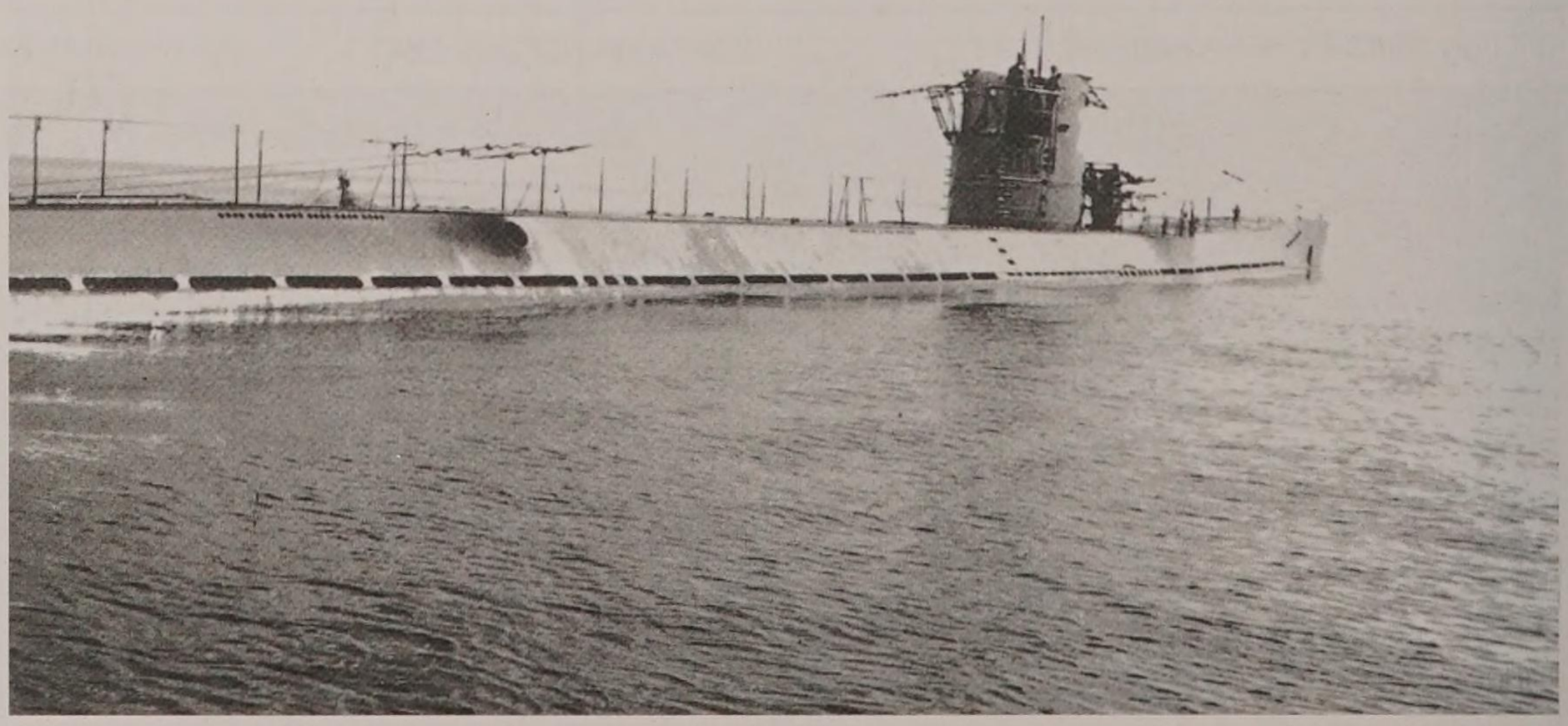
LEFT The Type VII class U-boat became the most successful – and most produced – type of submarine ever built anywhere before or since. *(Imperial War Museum)*

Type VII class U-boats were the most common type of medium-size German submarine used in the Second World War and were constructed from the best-quality naval steel the country's foundries could produce. They were the most widely used wartime U-boats and the most produced submarine class in history, with over 700 constructed. Between 1933 and 1941 several different variations of Type VII were built – or were intended to be built – each with improved or streamlined modifications to refine diving and operational performance. New machinery also provided greater propulsion above and below the waves – diesel motors for surface operations and electric motors when submerged. Each variation provided improved electronic and communications equipment, control rooms, enlarged conning towers, more efficient armaments, better diving characteristics and increased fuel oil capacity.

Type VII class variations

Type VIIA (U-27–U-36)

Type VIIA class U-boats were originally designed in the mid-1930s as the first in a series of new generation German attack



RIGHT U-27 was a Type VIIA U-boat and had a short career, with only one war patrol and two enemy ships sunk. Following the sinking of two British trawlers in 1939, U-27 was hunted down and sunk by depth charges from British destroyers west of Lewis, Scotland. All 38 crewmen survived and became prisoners for the remainder of the war. *(The Navy League, 1940)*

submarines. An initial order for six VIIAs from Krupp's Germaniawerft in Kiel was reduced to four in January 1938. At the same time Deschimag AG Weser in Bremen was awarded a contract to build a further six. The ten submarines were given 'U' numbers starting with U-27. The first Type VIIs set the general pattern for dimensions and characteristics for different variations that would follow.

The submarines were produced as single-hull vessels in which the pressure hull doubled as the outer hull of the boat. With all oil and fuel stored inside the pressure hull, ballast tanks took up much of the space below the control room decking and between the watertight bulkheads sealing the forward and aft ends.

The Type VIIA boats were more powerful than the smaller Type II U-boats they replaced, with four bow torpedo tubes and one external tube at the stern. Carrying 11 torpedoes on board, they were agile on the surface. A mounted 88mm fast-firing deck gun was able to discharge 15–18 rounds per minute.

Ten Type VIIA boats were built between 1935 and 1937 and all but two were sunk during the war. They were powered on the surface by a pair of MAN AG, 6-cylinder, 4-stroke M6V 40/46 diesels giving a total of 2,100–2,310bhp (1,600 to 1,720kW) at 470 to 485rpm. When submerged it was propelled by two BBC GG UB 720/8 electric motors giving a total of 750hp (560kW) at 322rpm.

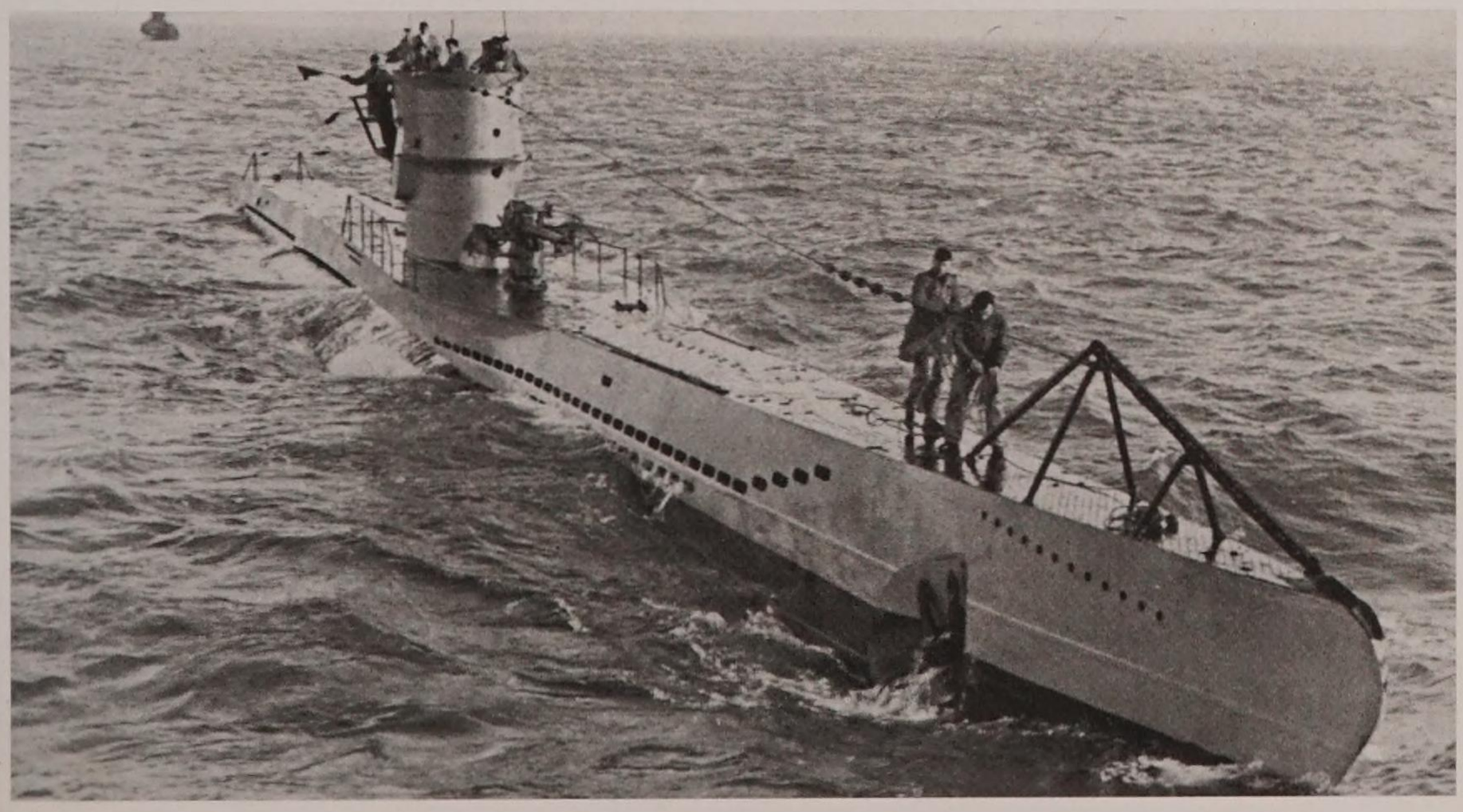
But crews working in Type VIIs found them uncomfortable, claustrophobic, noisy, hot and stinking when forced to live in them on long patrols lasting weeks or maybe even months on end. In their narrow tubular space, the air was always foul and the interior often damp. In his post-war memoir *U-boats at War*, former Kriegsmarine submariner Harald Busch recalled:

> *Throughout the U-boat the air would be heavy with odours – the penetrating, dungeonous reek from the bilges, the whiff of diesel oil and of unwashed humanity, the smell of cooking, of Colibri (a type of eau-de-Cologne used by the crew to remove salt encrusted on their faces by the seas which broke continuously over the bridge) and a generous contribution, despite an 'air purifier' from the direction of a door on overworked hinges (the toilet), where seldom indeed was the blue light not shining that signified 'engaged'.*

Type VIIB (U-45–U-55, U-73–U-76, U-83–U-87 and U-99–U-102)

Because of the Type VIIA's limited fuel capacity, 24 modified and improved Type VIIB boats were commissioned by the Kriegsmarine between 1936 and 1940. Type VIIA plans were reworked in an attempt to develop a better variant for the VIIB model in other aspects.

Additional space was provided to store an extra 33 tons of fuel in external saddle tanks to add another 4,600km of range at 19km/h when surfaced. Modifications also reduced



LEFT Type VIIB U-101, ordered on 15 December 1937 and laid down on 31 March 1939 at Germaniawerft, Kiel. She was launched on 13 January 1940 and had a highly successful career, sinking 35 ships (totalling 198,218grt), three auxiliary warships (totalling 46,440grt), five ships damaged (37,965grt) and one ship taken as a prize (2,136grt). *(The Navy League, 1945)*

ABOVE AND BELOW
Unlike other U-boats, which during their service lost men due to accidents and enemy attacks, Type VIIB boat U-45 did not suffer any casualties until the time of her loss when she was sunk on 14 October 1939 south-west of Ireland by depth charges from British destroyers HMS *Inglefield*, HMS *Ivanhoe* and HMS *Intrepid*. The boat's entire crew of 38 officers and men were all lost. In her short life U-45 sunk two ships which amounted to a total tonnage of 19,313grt.
(Bundesarchiv)

the boat's underwater turning radius by placing a rudder behind each twin screw and doubling the rudder area. An added benefit of this arrangement allowed the rear torpedo tube, which had been mounted externally on Type VIIA boats, to be repositioned inside the pressure hull of the new boats and firing out between the rudders. Torpedo storage was also improved by stowing reloads for the stern torpedo tube within the hull and under the motor room deck. A pair of external storage tubes – one each forward and aft – were added between the pressure hull and the deck casing.

Speed power was boosted by 20% through the use of superchargers on the MAN 6-cylinder, 4-stroke M6V 40/46 diesels. Range was improved by increasing fuel bunkerage. The Type VIIB was also lengthened by 2m, which slightly increased the capacity in its internal fuel tanks.

The first seven Type VIIB boats were ordered from Krupp's Germaniawerft as U-45–U-51 in November 1936. Early the following year, the British and German governments restarted negotiations regarding Germany's post-First World War naval agreement. Germany demanded concessions to bring the permitted number of submarines to fall in line with other countries. In anticipation of being granted permission to increase U-boat output, orders were placed with Germaniawerft for two extra Type VIIBs in May 1937 and a further two were ordered the following July. After the revised agreement was signed, Germany was permitted to manufacture 45% of the Royal Navy's total submarine tonnage – the equivalent of 31,500 tons. From December 1937 to June 1938 twelve more Type VIIBs in three batches were ordered from Germaniawerft and the smaller yards of Bremer Vulkan-Vegesacker Werft in Bremen and Flender Werke in Lübeck.

Type VIIBs incorporated many of the most famous U-boats of the Second World War, including U-48 which sank or damaged shipping totalling 328,414grt. Other successful Type VIIBs included Otto Kretschmer's U-99 (282,623grt), Günther Prien's U-47 (254,670grt) and Joachim Schepke's U-100 (155,048grt).

On the surface the boat was powered by two supercharged MAN 6-cylinder, 4-stroke M6V 40/46 diesels (except for U-45–U-50, U-83, U-85, U-87, U-99, U-100 and U-102, which were powered by a pair of supercharged

Germaniawerft 6-cylinder, 4-stroke F46 diesels) giving a total of 2,800–3,200bhp (2,400kW) at 470–490rpm. When submerged, the boat was powered by two AEG GU 460/8-276 electric motors (except in U-45, U-46, U-49, U-51, U-52, U-54, U-73–U-76, U-99 and U-100, which retained the original BBC motor used on Type VIIA boats) giving a total of 750shp (560kW) at 295rpm.

Type VIIC (U-69–U-72, U-77–U-82, U-88–U-98, U-132–U-136, U-201–U-212, U-212–U232, U-235–U258, U-465–U-486, U-551–U-790, U-821–U-840, U-901–U-1058, U-1063–U-1080, U-1101–U-1220, U-1271–U-1330)

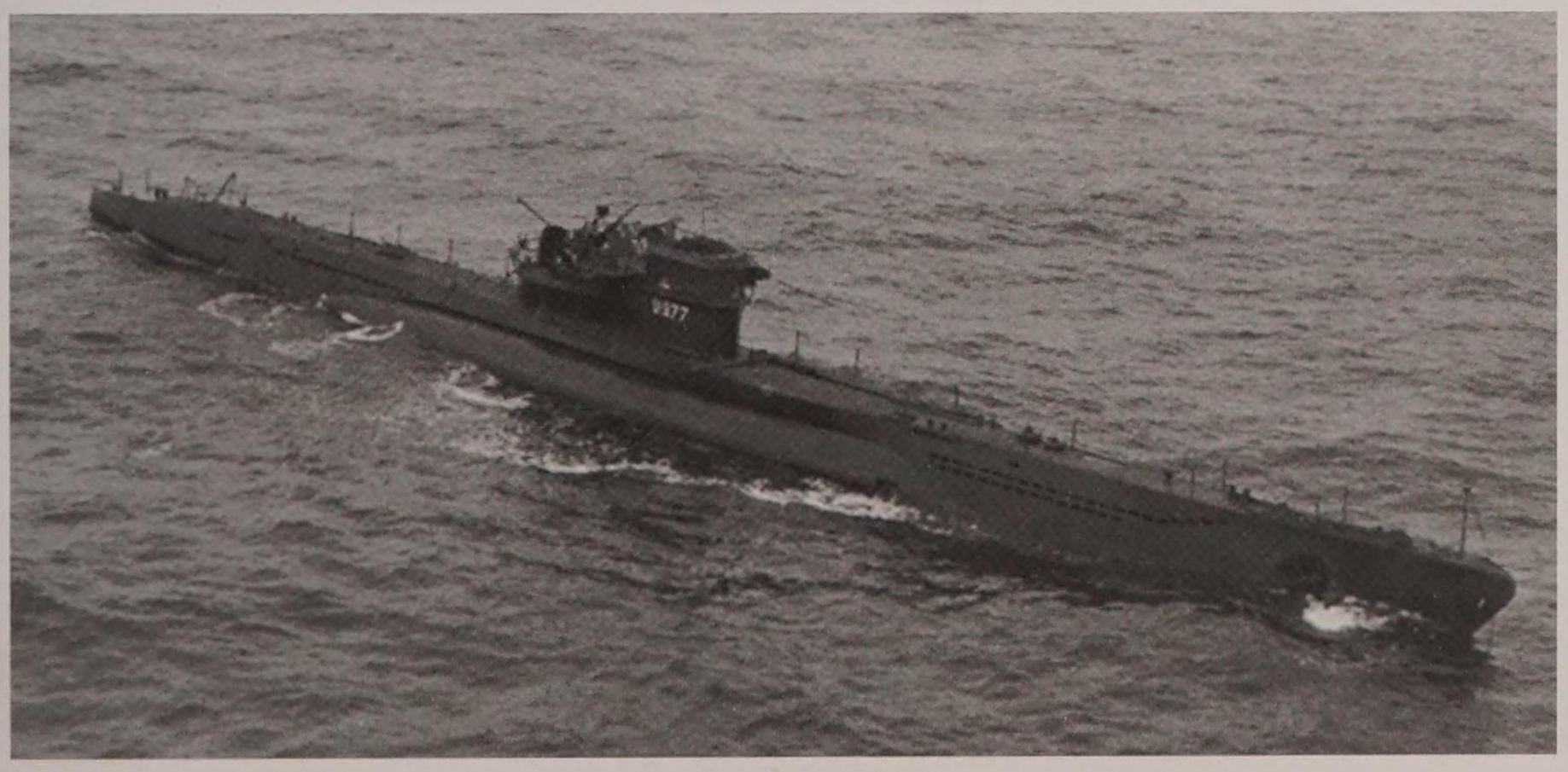
The Type VIIB became exactly the boat that *Führer der U-Boote* (U-boat leader) Karl Dönitz – and the entire U-boat command – was hoping it would be. 'Never, in my opinion, have Germans in the front line been so convinced of the quality of their technical material and type of boat as the German U-boat men in this war,' he recalled in his memoirs. But many senior Kriegsmarine officers were pressing for the development of bigger, faster, longer-ranging boats, which would only be ready for use during later wartime years.

The Type VIIC class was not produced because of any dissatisfaction with previous models, but because new, superior technology had become available and the creation of a new version of the submarine would give the Kriegsmarine opportunities to use newly acquired know-how. This included *S-Gerät* (search equipment also known as Special Apparatus for Active Sound Location), essentially an active sonar able to transmit sound pulses and timed returned echoes and which also detected underwater objects up to 4,000m away, including minefields or targets. Because it emitted sound pulses which also broadcast the U-boat's position, the device was unpopular with U-boat crews. The equipment's design was adapted and fitted into all new VIIC U-boats – apart from early models where it was found to be unsuitable when fitted into control rooms.

Other additions and modifications to the new model included an enlarged space within the conning tower, which was increased by 30cm in length and 6cm in width. Beneath the control room, the aft internal fuel tank was extended by a further 60cm, providing a total extra 5.4m² in increased volume.

Externally, redesigned saddle tanks provided room for a small buoyancy tank on both sides which, when blown, provided extra buoyancy and, when used in combat, could be partially flooded to allow quicker dives.

Type VIIC boats also received upgrades to their mechanical systems, including new oil filtration systems to prolong the life of its diesel oil lubricating system and improve the range possible from a fixed amount of lubricant. An electric compressor used to fill compressed air tanks to fire torpedoes and blow ballast tanks was replaced by a Junkers diesel-powered compressor, reducing demands on the boat's



LEFT Type VIIC U-977 showing its full flak defence suite and spruced up following her capture by US forces. She took part in a victory tour of the eastern seaboard of the USA in November 1945. *(US Navy photograph)*

electrical system. The outdated electrical control system used in earlier Type VII models featured knob switches to control the flow of electricity in a circuit. These were replaced by new knob switch systems manufactured by AEG.

Before the end of 1939, orders for 131 Type VIICs had been distributed among 13 shipyards and the boats became the standard U-boat type of the Kriegsmarine's U-boat force, with 568 commissioned from 1940 to 1945. The first VIIC boat to enter service was U-69 in 1940. It became a highly effective fighting machine and operated everywhere where U-boats hunted for their kill, even though it was marginally slower than its predecessors, owing to its increased size which was not matched by increased power. Its range of 6,500nm was not as great as that of larger Type IX boats (range 11,000nm), severely limiting the time it could spend in far reaches of the western and southern Atlantic without refuelling from a tender or U-boat tanker.

However, U-69 did its fair share of damage during the 27 months it patrolled waters of the North Sea, mid-Atlantic, West Africa, Caribbean and Newfoundland on ten different patrols, sending 77,340grt of shipping to the seabed. In February 1943 U-69 was part of a wolfpack (see pages 146–150, *Achtung wolfsrudel!* – beware wolfpacks!) involved in attacking a convoy east of Newfoundland and was forced to surface by depth charges. The boat was rammed by HMS *Fame* and neither *Kapitänleutnant* Ulrich Gräf nor his crew of 45 survived the sinking.

The VIIC came into operational service towards the end of the first '*Die Glückliche Zeit*' – 'The Happy Time', at the start of the war when numerous factors contributed to the success of operations carried out by U-boats led by intelligent, bold, brave, skilled and intuitive commanders attacking convoys. Most of the U-boats they commanded gave excellent torpedo performance in night surface attacks on British convoy escorts that were sometimes inadequate and inept. U-boat commanders also had a long lucky streak in which to make their presence felt in the face of the enemy. VIIC boats were still the most numerous type in service when Allied anti-submarine efforts finally defeated the U-boat campaign in late 1943 and 1944.

Type VIIC boats had the same torpedo tube arrangement as their predecessors, except for U-72, U-78, U-80, U-554 and U-555, which had only two bow tubes (instead of four) and U-203, U-331, U-351, U-401, U-431 and U-651, which had no stern tubes at all.

On the surface most of the boats were propelled by two supercharged Germaniawerft, 6-cylinder, 4-stroke M6V 40/46 diesels totalling 2,800–3,200hp (2,100 to 2,400kW) at 470–490rpm. For submerged propulsion, several different electric motors were used. Early models used the VIIB configuration of two AEG GU 460/8-276 electric motors, totalling 750hp (560kW) with a maximum rpm of 296, while newer boats used two Brown, Boveri & Co. (BBC) GG UB 720/8, two GL (Garbe, Lahmeyer & Co.) RP 137/c electric motors or two Siemens-Schuckertwerke (SSW) GU 343/38-8 electric motors with the same power output as the AEG motors.

Reflecting on the popularity of Type VIIC boats, Dönitz wrote:

> *The great U-boat aces such as Kapitänleutnant Prien, Kretschmer and Schepke, were all VIIC drivers. They swore by this type of boat and when changing boats did not wish to take over any of the new, large ones. Never, in my opinion, have Germans in the front line been so convinced of the quality of their technical material and type of boat as the German U-boat men in this war.*

Perhaps the most famous VIIC boat was U-96, which was featured in the award-winning 1981 German film *Das Boot*. It was based on a novel of the same name about the experiences of Lothar-Günther Buchheim, complete with a number of fictional additions to the story to keep cinemagoers happy.

Type VIIC/41 (U-1093–U-1100, U-1331–U-1404, U-1417–U-1500, U-1801–U-2110, U-2301–U-2320)

From 1940 to 1943, manufacturing time for a Type VII U-boat took around ten months. Shipyards adopted a system of prefabrication for the hull section, while the remainder of the building process was slow, as everything for the

interiors – including the engines – had to make its way inside the hull through narrow hatches.

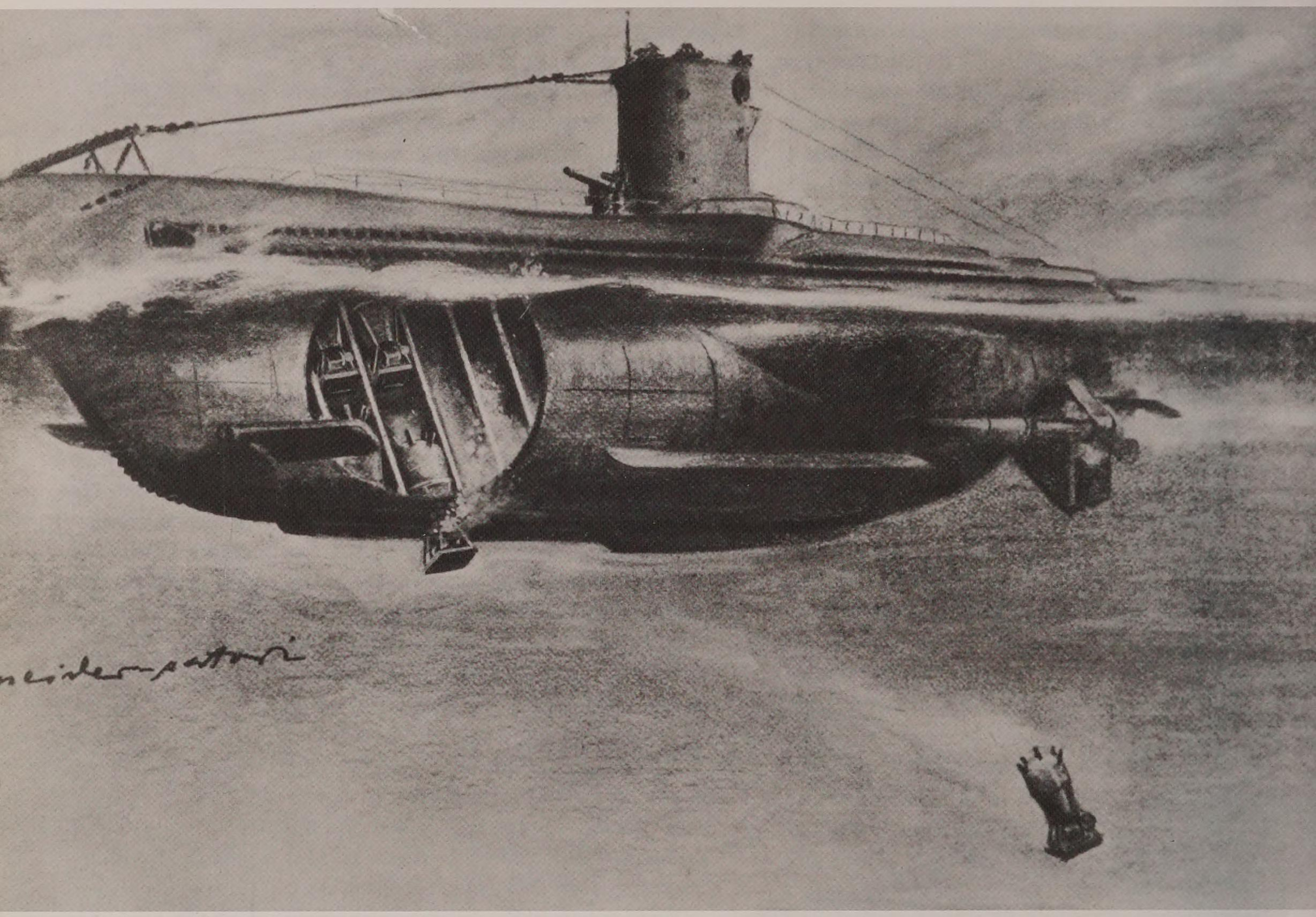
By working 24 hours a day, 7 days a week, shipyards assembled 24–26 new U-boats per month of Types VIIC, IXC and IXD, which was still considered too few by the Kriegsmarine high command. An alternative construction method was needed to get greater numbers of U-boats off the production line and into active service and the answer came by placing orders with more shipyards – many of which used forced labour to work on their production lines.

Orders for the first of 92 Type VIIC/41s were placed in October 1941 with a view to the first boats going into service early in 1942. The model was designed as another variation on the original Type VII design, with a stronger pressure hull providing more depth to evade attack (operational 120m and crush depth at 250m against the Type VIIC's 100/200) and a skin thickness up to 28mm, allowing them to dive twice as deep as previous VIICs.

The Type VIIC/41 boats had two periscopes and carried lighter machinery to compensate for added steel in the hull, making them slightly lighter than the VIIC. Existing electrical equipment was replaced by new, compact models, and the use of thicker steel plate in the pressure hull cut 11 tons from the submarine's usual weight, allowing an increase in diving capabilities from a maximum depth of 250m to 300m.

It was envisaged that the VIIC/41 design would produce another sub-variant to be named the Type VIIC/42. The design was intended to have newly developed turbochargers to increase speed, additional length to provide better fuel storage capabilities and armour plate replacing normal steel for the pressure hull, allowing the boat to dive to a record 500m. Contracts were signed

BELOW Type VIIC/41 U-995 – the only Type VII class submarine still in existence and now a museum exhibit at Laboe, Germany.



ABOVE A Type VIID minelaying U-boat. The caption for this January 1940 image reads: 'How Nazis Sow Their Mines. This German drawing shows how submarines plant their mines from slotted chambers in the bottom of the U-boat.' *(Acme Newspictures Inc., New York)*

for 164 Type VIIC/42 boats, but only a small number were laid down and all were cancelled in September 1943 in favour of the new Type XXI. Submarines in the shipyard not advanced enough in their construction to be launched were scrapped. If the VIIC/42 had entered service, it would have been powered by the same engines as the VIIC.

Only one Type VIIC/41 still exists – U-995 – which surrendered to British forces in Trondheim, Norway, on 8 May 1945 after sinking 9,474grt. The boat later transferred to the ownership of the Royal Norwegian Navy in October 1948. In December 1952, U-995 became the Norwegian submarine *Kaura* and in 1965 was retired and sold back to Germany for the symbolic price of 1 Deutsche Mark to become a museum ship in 1971 carrying its original designation of U-995. Today she is open to the public at the Laboe Naval Memorial and receives over 350,000 annual visitors from around the world.

Type VIID (U-213–U-218)

Six Type VIID class boats were lengthened by 10m and used as minelayers. Mines were transported and released from three banks of five vertical tubes forward of the conning tower. The extended hull also provided extra space for fuel and food storage.

On the surface, the boat used two supercharged Germaniawerft, 6-cylinder, 4-stroke F46 diesels delivering 3,200bhp (2,400kW) at between 470 and 490rpm. When submerged, the boat used two AEG GU 460/8-276 electric motors, giving a total of 750shp (560kW) at 285rpm.

Only one Type VIID – U-218 – managed to survive the war after sending 14,884grt to a watery grave. On 12 May 1945, Commander Rupprecht Stock surrendered the boat in Bergen, Norway. It was later sunk in 1945 off the coast of Northern Ireland as part of Operation Deadlight, the code name for the

scuttling of unwanted German U-boats after the war (see pages 66–67, Operation Deadlight). Five other Type VIID boats were sunk, with all crew members lost.

Type VIIE

This boat only existed on a drawing board as part of an attempt to build a submarine powered by an entirely new type of lightweight engine and, with the saved weight, it was intended that the thickness of the pressure hull be increased to allow for greater diving depths. The engine development, based on a Deutz V-12 two-stroke diesel engine, was subject to delay. Consequently progress was terminated and the Type VIIE was never laid down.

Type VIIF (U-1059–U-1062)

Designed in 1941 but not ready for use until 1943, Type VIIF boats were primarily built as specialised torpedo supply transporters to rearm U-boats otherwise frequently forced to return to port after using up their torpedo supplies. As U-boats ventured farther afield, the supply of torpedoes was often a limiting factor in the success of a patrol and a method to rearm boats had been sought to eliminate the need to return to base.

Type VIIF boats were the largest, heaviest and longest Type VII boats built. The armament was identical to the other Type VIIs, except they could carry up to 39 supply torpedoes on board and had no deck guns.

To accommodate additional torpedoes a new 10.5m section was inserted forward of the control room, which contained twenty-four torpedoes arranged in four layers of six. An additional aft-facing torpedo hatch, fitted with a system of pulleys, was inserted into the deck to enable torpedoes to be hauled up from the storage area and transferred between U-boats while at sea. The upper deck was also widened to further accommodate the difficult and delicate task of transferring torpedoes.

The physical transfer of torpedoes at sea in the North Atlantic, however, seldom worked. It was a long, slow and arduous process. Achieving the transfer of a torpedo from one submarine to another at sea involved two U-boats secured to each other. This prevented either submarine from diving if enemy aircraft or ships appeared, making them vulnerable to enemy fire until the transfer was complete.

Additional space in the 77.6m-long VIIF provided crew with room for extra bunks, a pair of large refrigerated food lockers and additional oil bunkerage in the saddle tanks.

Only four Type VIIFs were built. Two of them, U-1059 and U-1062, were sent to support *Gruppe Monsun* (Monsoon Group), a force of German U-boats operating in the Pacific and Indian Oceans. U-boats U-1060 and U-1061 remained in the Atlantic. The boats were also used to deliver supplies to isolated areas of Norway and the Arctic.

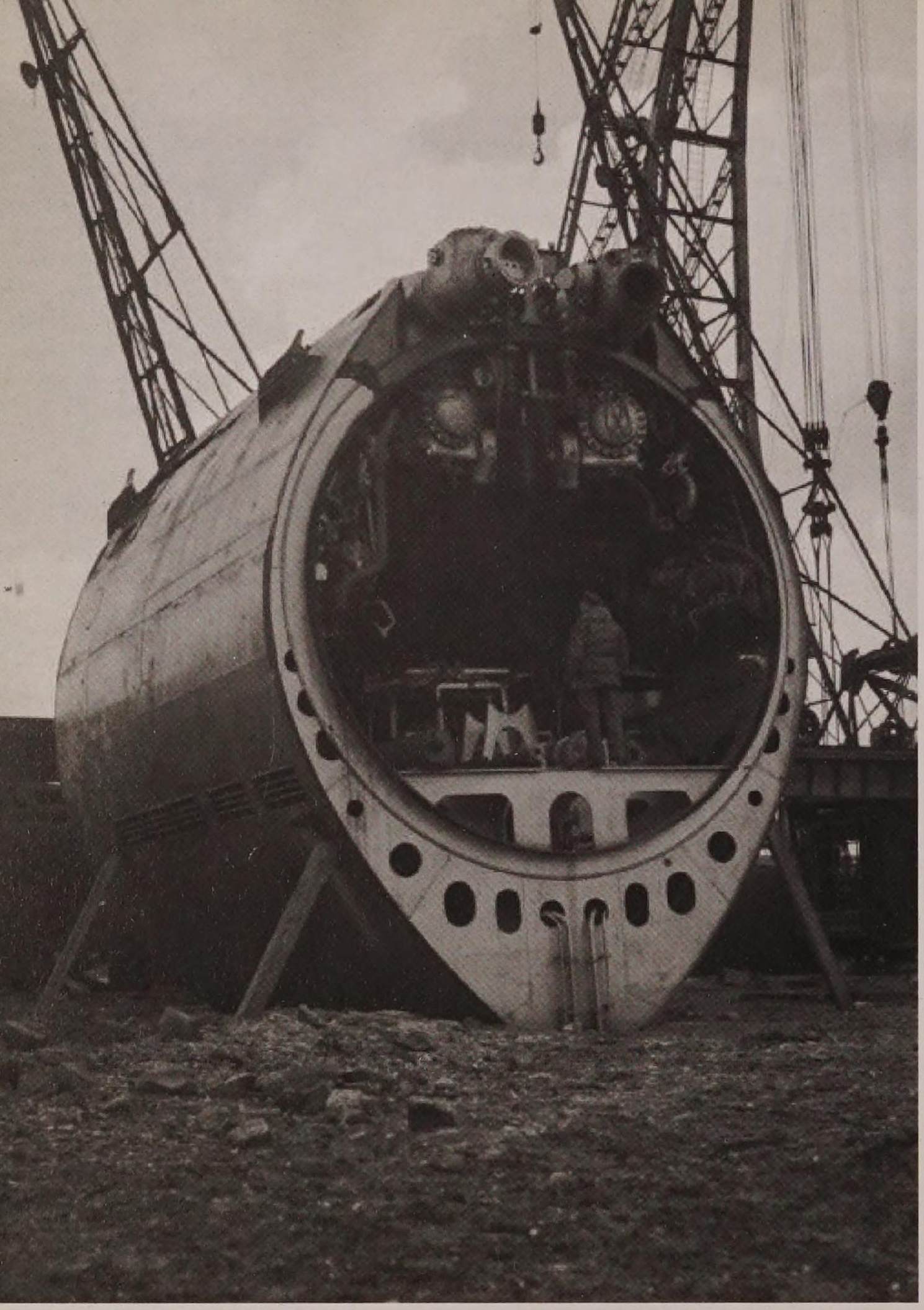
Type VIIF U-boats used the same engines as the Type VIID class. Three were sunk during the war and the last was scuttled in 1945 along with the majority of surrendered U boats.

Type VII class U-boats – external and internal sections

External sections

The **pressure hull** in a Type VII class submarine comprised an inner hull which, together with an outer hull, acted as one tube inside another and was constructed to withstand the pressure of water at the greatest

BELOW The pressure hull section of a Type VII U-boat built up from rolled sheet steel plating welded over a set of ribs. This photograph was taken at Krupp's Germania-werft factory, Kiel, in 1938. *(Karl Parlour)*



LEFT The centre section of a Type VIIC U-boat at Deschimag AG Weser factory, Bremen. *(Imperial War Museum)*

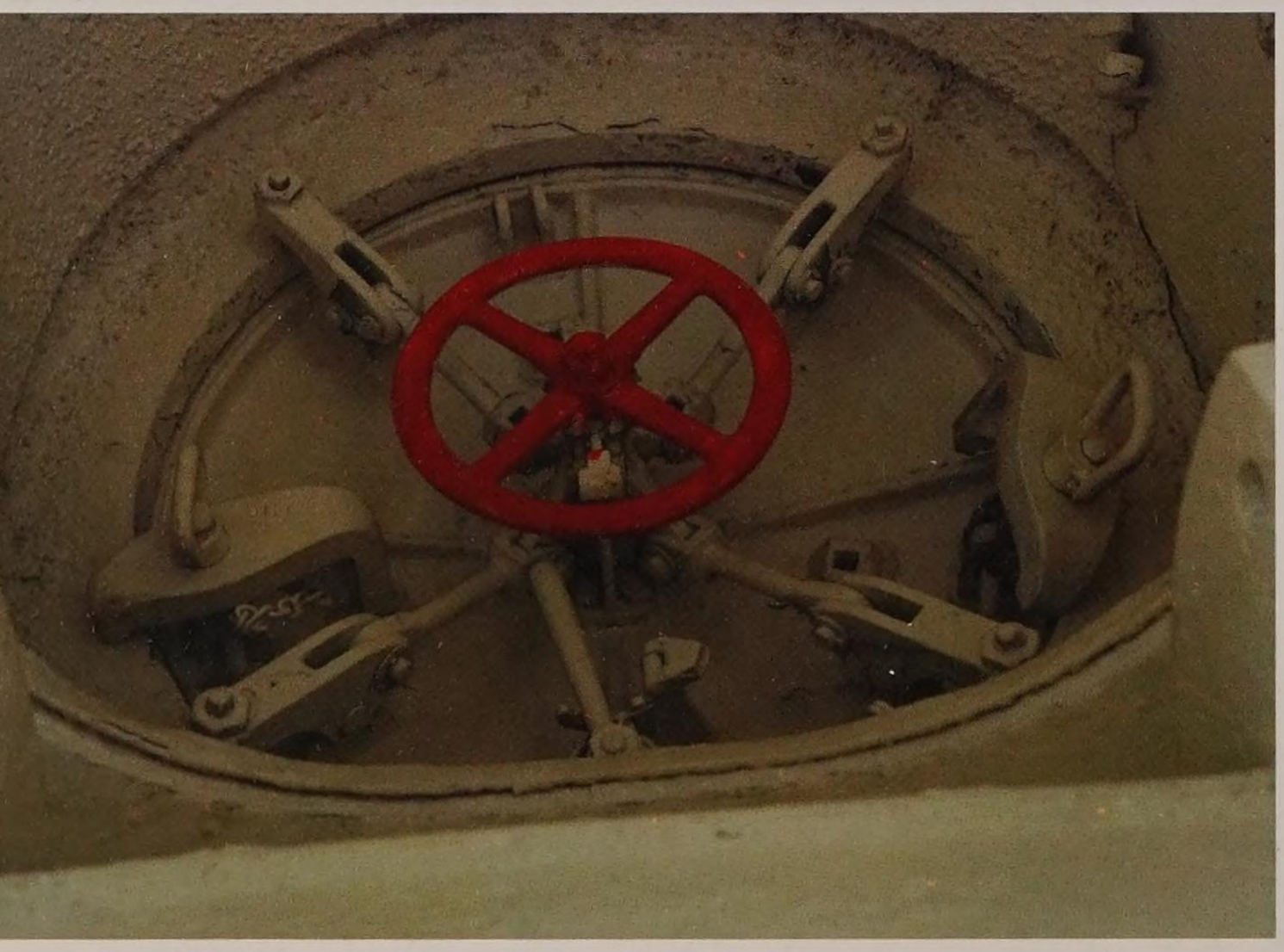
depth for which the boat was designed. The space between the two was flooded with water to submerge. The amount of water in this space – the ballast tanks – made the boat lighter, neutrally buoyant, or heavier than sea water, allowing it to dive.

The pressure hull had a circular cross-section over its full length, consisting of one cylindrical and seven cone-shaped parts made from rolled naval construction sheet steel with an ultimate tensile stress of 52–61kg/33–39 tons per square inch. The hull thickness of a Type VII boat was between 9.5mm and 11.5mm. Steel used to make the U-boats was the same quality material used to build destroyers and battlecruisers like the *Scharnhorst* for the Kriegsmarine.

These parts were joined together by means of arc welding and strengthened inside by 82 separate frames manufactured from pre-stressed bulb-tee girders that were ideal for long-span structures, providing resistance to lateral bending and contributing to torsional rigidity.

Extra stressed areas (such as beneath the conning tower, around the aft torpedo hatch, exhaust valves and the diesel engine room area) were further strengthened by thicker plates. Both ends of the pressure hull were enclosed by two outside-cambered dished plates. The forward end was strengthened to account for weakening owing to the presence of openings for four torpedo tubes. The thickness of plating in the cylindrical part of the hull was 18.5mm, decreasing towards the forward and aft ends and in conical parts to 16mm. The thickness of plating at both hull endings was 35mm.

Dive planes, taking the form of fins, helped steer the boat up or down when submerged. There was also a rudder, which acted in the same way as a conventional ship's rudder to control left and right movement. Compressed air was used to

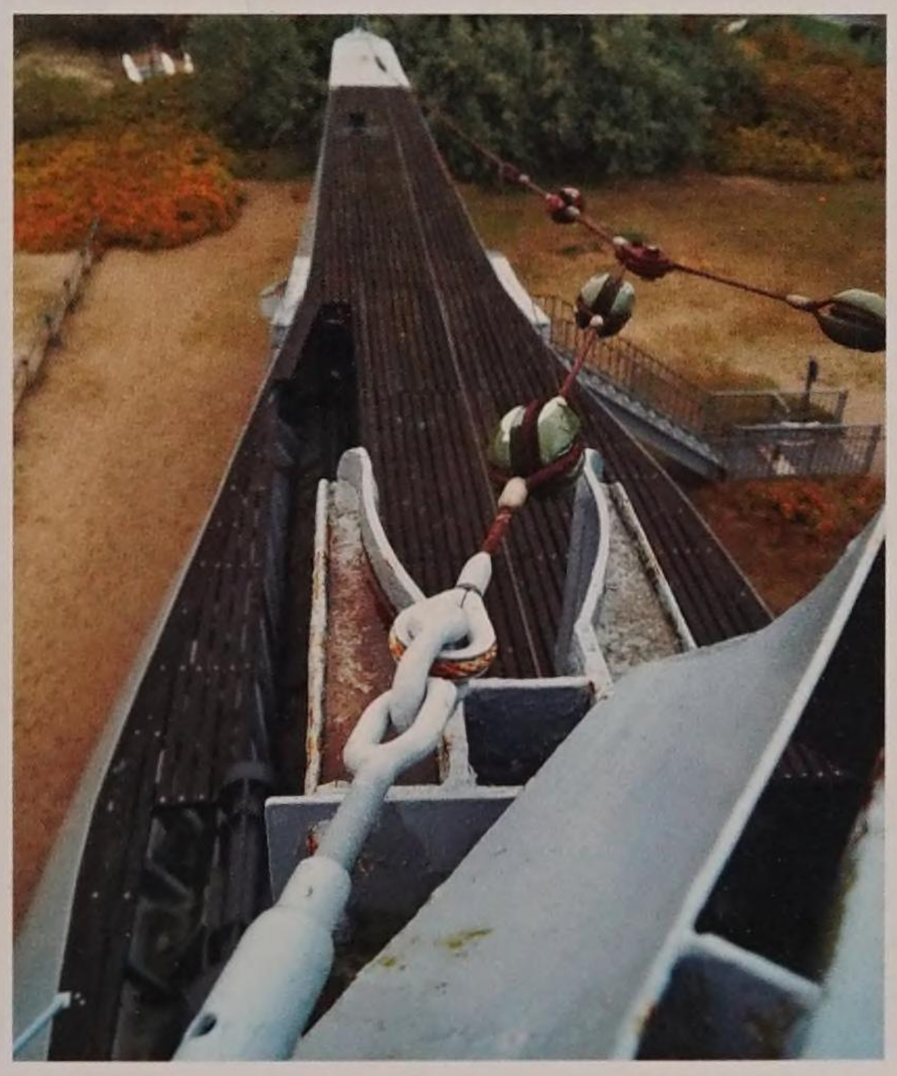


LEFT The aft torpedo hatch used to load torpedoes down from the deck into the electric (E) motor room for storage.

force seawater from the ballast tanks when the submarine needed to surface.

The foredeck of a Type VII boat was an extension of the external bow leading back to the conning tower. The upper surface of the deck was covered with hardwood planking spaced 1cm apart. Wood was used because metal surfaces froze during winter months. Numerous sections of planking were hinged or made removable to allow access to various hatchways and storage areas below.

Motors and gearing used to haul in the anchor were located at the bow. Aft of this was a hinged door access to the forward torpedo hatch, which projected nearly all the way up to the deck planks. This section also housed a watertight container for ready ammunition for the 8.8cm deck gun and supports for the gun itself.



ABOVE The twin rudders acted in the same way as on a conventional surface vessel to control lateral movement.

LEFT The hardwood-clad upper foredeck.

ABOVE Anchor.

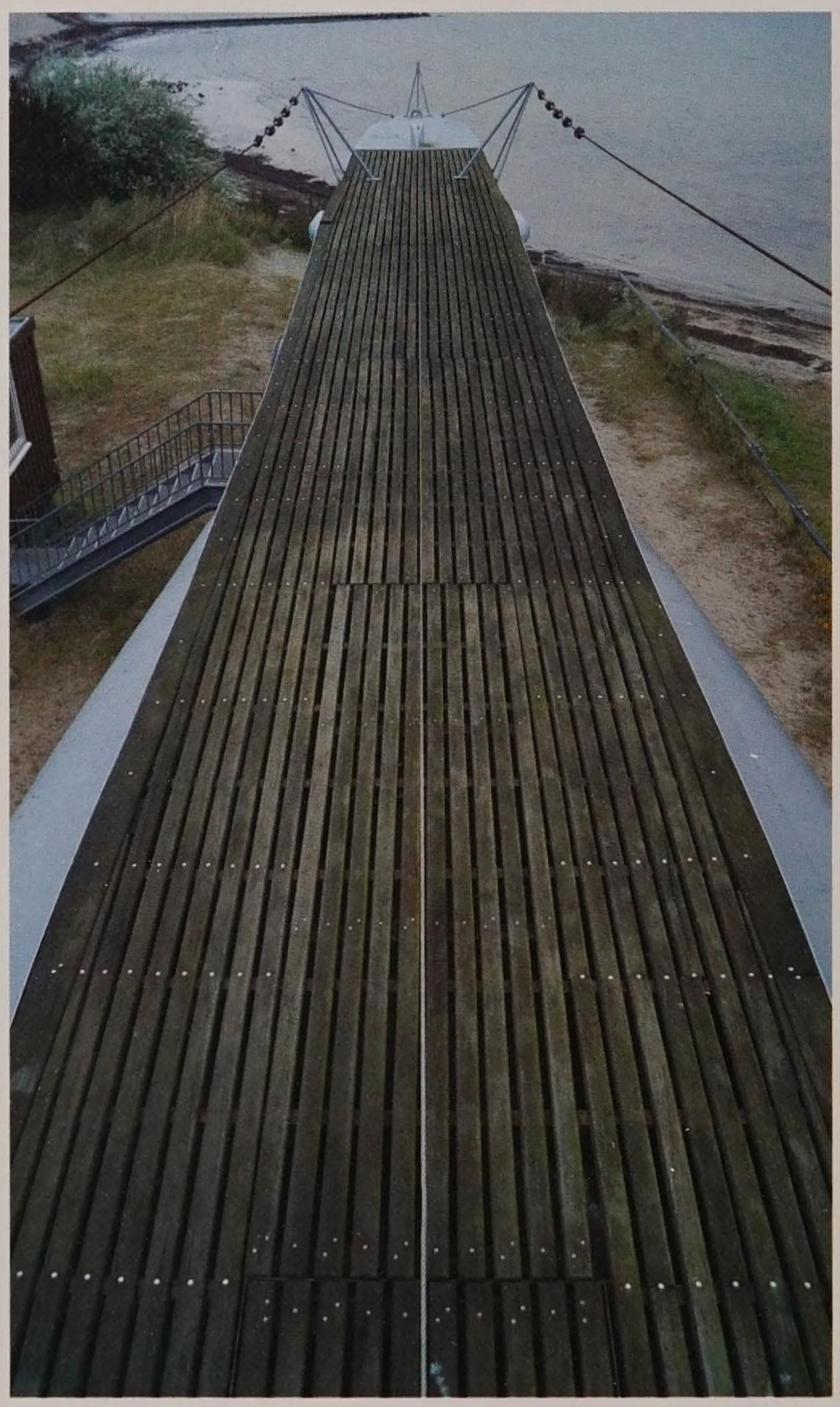
BELOW LEFT Upper deck, aft.

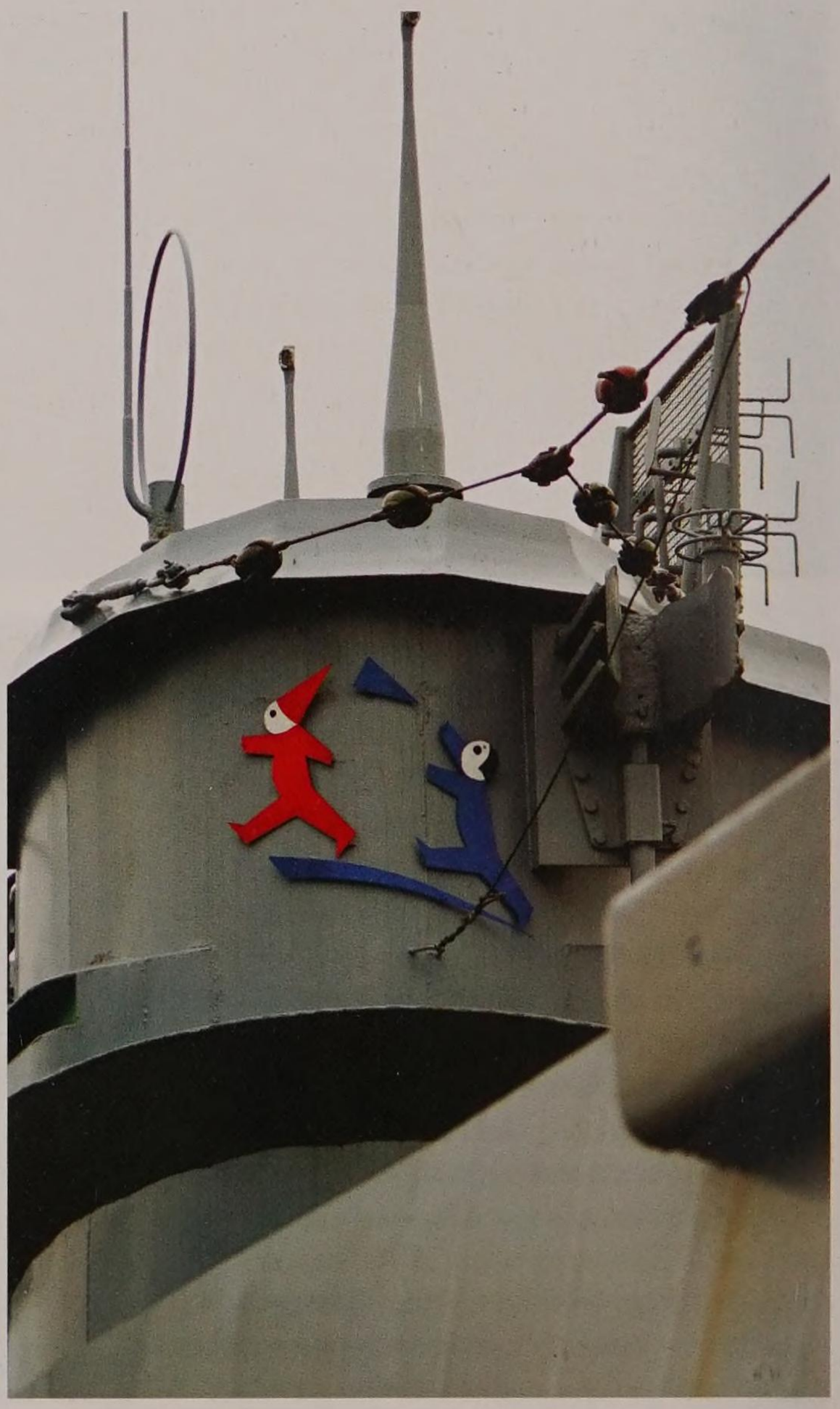
BELOW RIGHT Conning tower.

Between them was access to the forward battery hatch. Unlike other hatches in the pressure hull, this one was intended to be opened only in the dockyard to replace battery cells.

The aft deck casing housed hinged deck plating access to the galley's loading hatch and the aft torpedo storage tube. An area between the upper decking and pressure hull aft of the tower was taken up by ventilation tanking, which ran forward from the engine room to the tower, and exhaust trucking line and mufflers, which ran aft to the exhaust ports on each side of the engine room.

The Type VII's **conning tower** (*Turmumbau* or *Turm* for short) was a prominent arc-shaped superstructure projecting above the submarine's main hull made from 32mm-thick chromium-nickel-molybdenum steel plates. When



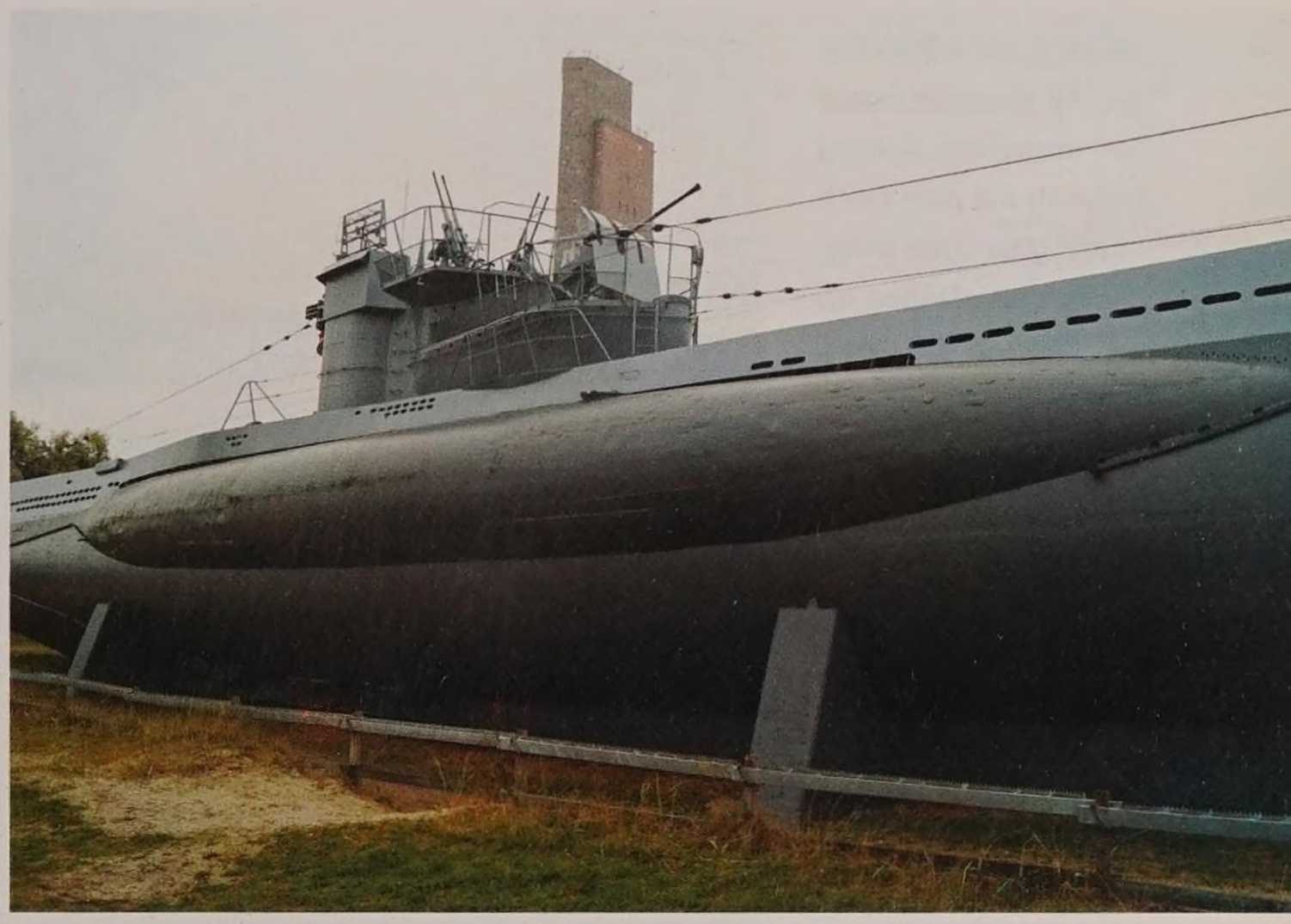


surfaced, the U-boat was steered from the top of the conning tower and when submerged operated from the control room directly below.

The conning tower was accessed by a ladder in the centre of the control room leading up to a hatch which, when opened, allowed crew to climb into a small watertight compartment projecting 2m above the pressure hull and equipped with instruments and controls. It covered a radius of the forward arc of 575mm and side arcs of 2,260mm. It was from this tiny space that an 'attack periscope' was used to direct the boat and launch torpedo strikes. The encased space also included a torpedo data computer to calculate the angle at which the torpedo would have to turn in order to hit its designated target.

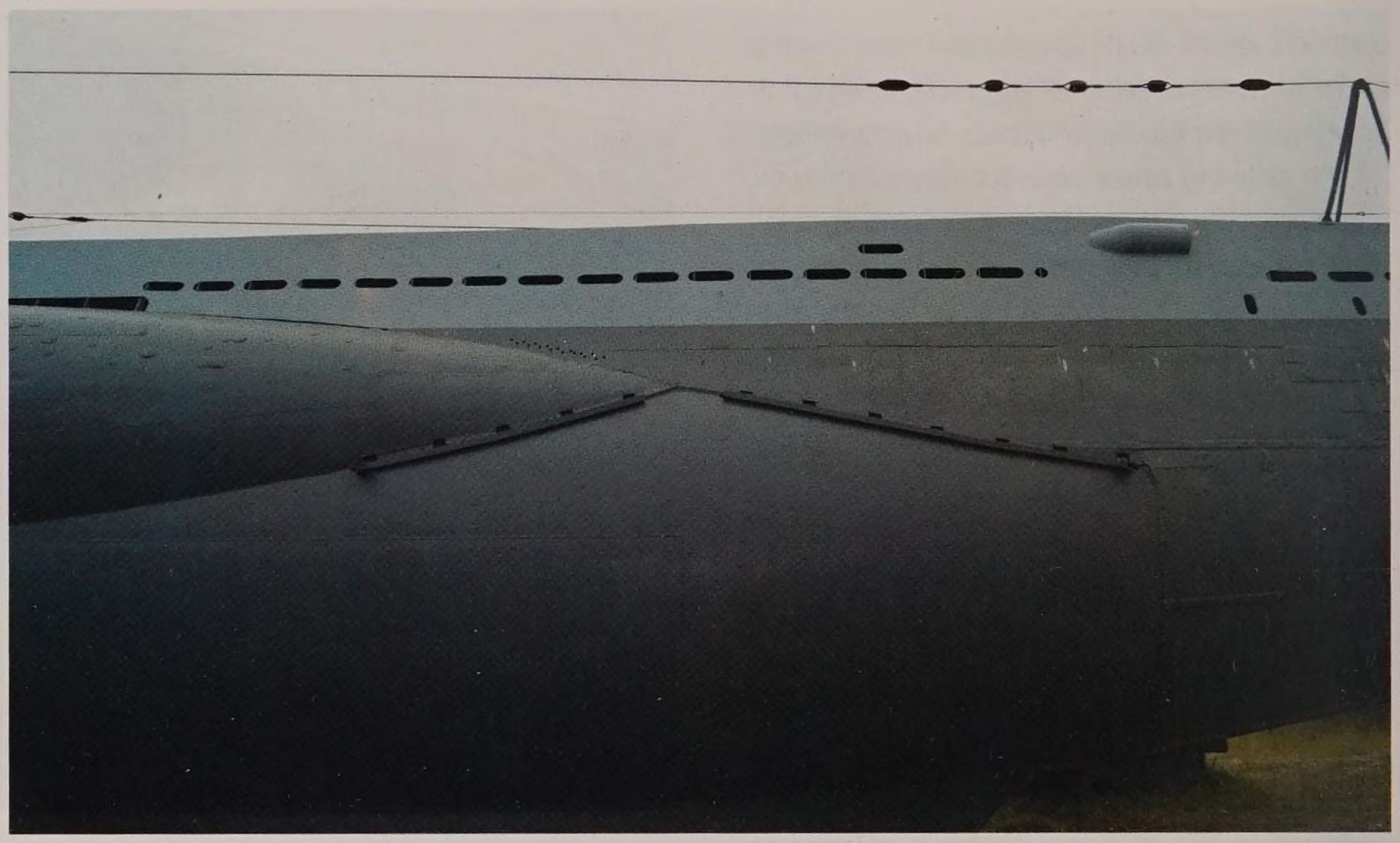
During a submerged attack, the boat's commander sat on a seat similar in appearance to a large bicycle saddle and peered into the periscope, verbally relaying the target's speed and bearing to the *Wachoffizier* (first watch officer) beside him. The *Wachoffizier* then posted the coordinates into the torpedo data computer, which transmitted information down to the torpedo room. When he was ready to fire torpedoes, the commander would give the order to launch: '*Torpedo rapedo ein. Los!*' ('Tube one – go!').

Type VII boats were designed with a **single hull**, allowing the pressure hull to double as an outer watertight hull. Wrapped around this, forward and aft, was a thin, non-watertight streamlining structure designed to offer the least resistance to fluid flow. On either side of the boat were long, bulbous saddle tanks with room



ABOVE AND RIGHT **A major drawback facing Type VIIA boats was the small amount of fuel storage available for its intended role as an attack boat undertaking long war patrols. Later modified versions – such as the Type VIIC/41 pictured here, showing the starboard external saddle tank – carried an additional 33 tons of fuel in external saddle tanks, giving the boat an extra 2,500nm range. These improved boats were more powerful, agile and faster than original Type VIIA boats, with the addition of submerged twin rudders, propellers and hydroplanes instead of the single ones fitted to original designs.**

RIGHT AND BELOW
All VII class boats had large free-flowing holes in the side deck casing to drain away seawater washed on to the deck.



for two more large tanks on each side. These provided the necessary buoyancy and ballast and gave the Type VII class its characteristic 'bulged' appearance.

Running along the top of the vessel was a substantial flat wooden **deck casing**, which provided a stable surface for any work needing to be undertaken on top of the vessel. An area between the deck casing and pressure hull provided adequate space for plumbing, wiring and ducting needed to ventilate the boat and receive fuel. It was also used for torpedo storage, air trucks, ammunition stowage and storage of inflatable air rafts. All VII class boats

LEFT Conning tower with 'bandstand' and 'winter garden'.

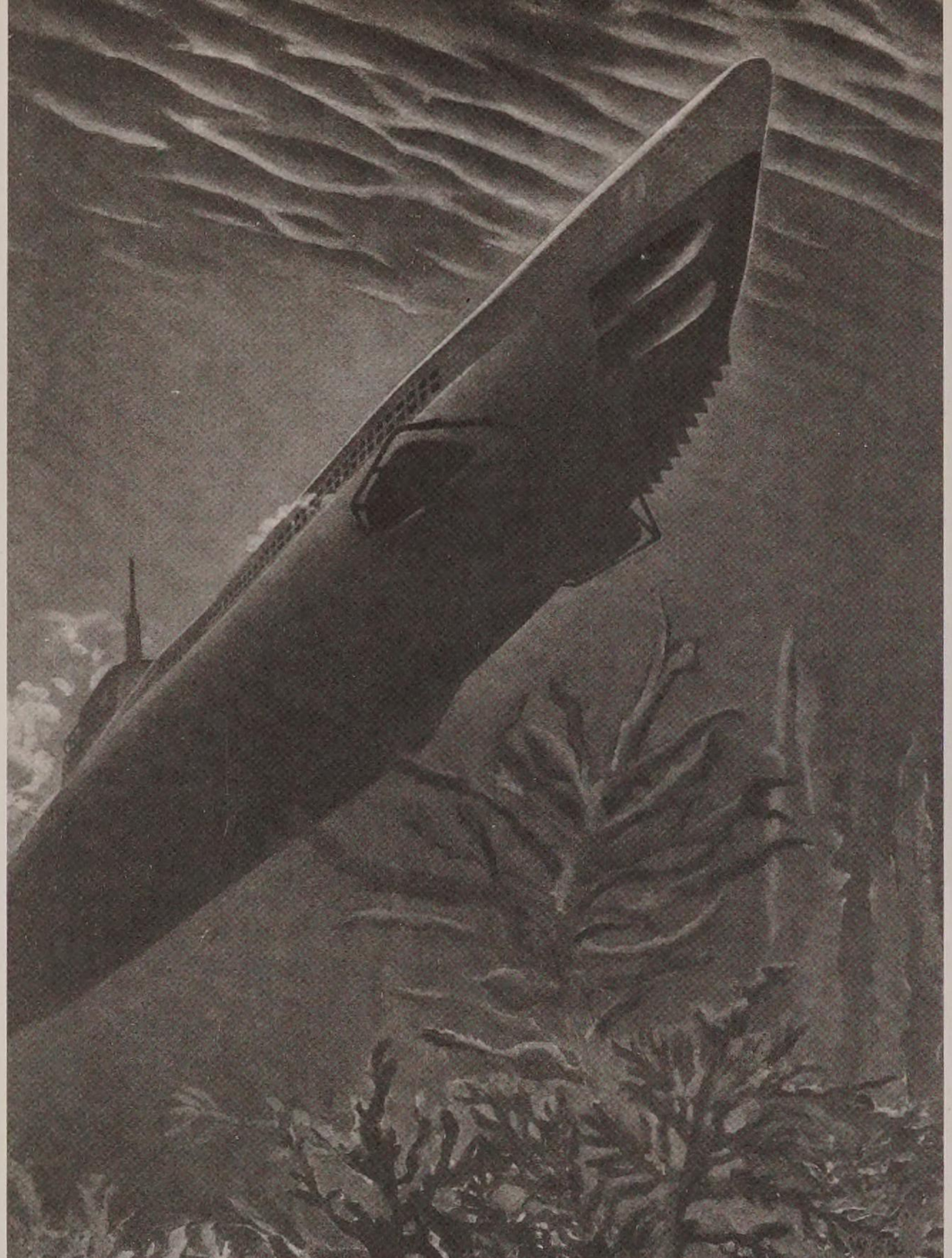
BELOW The bridge area on top of the conning tower.

had large free-flowing holes in the side deck casing to drain away seawater washed on to the deck.

The submarine's **conning tower** was another multi-layer structure. Surrounding it was an external tower structure and on top of it a bridge providing a protected site for crew members acting as lookouts once the boat had surfaced.

Of the eight sections of rolled sheet steel making up the pressure hull, only the two centre sections were cylindrical in shape. The remaining sections were truncated cones constructed by welding the rolled sheet steel that comprised the pressure hull skin to a set of circular ribs spaced at 60cm intervals. The only exceptions were the very ends of the hull, which were prefabricated rolled and stamped pieces, two half-conic sections and a spherical section end cap.

Over the entire boat, from bow to stern, was a '**jumping wire**' stretched and attached to the bridge bulwark to allow U-boats to attempt to pass under or through anti-submarine nets and other submerged defences without obstructions snagging the vessel's superstructure. Nets proved to be an effective anti-submarine device. They were strung out across the English Channel, making it almost impossible for U-boats to pass through, and were used to protect harbours in both the United States and Canada. If a submarine became entangled in a net, it had no option but to surface and face



LEFT Anti-submarine net and U-boat with serrated net-cutters.

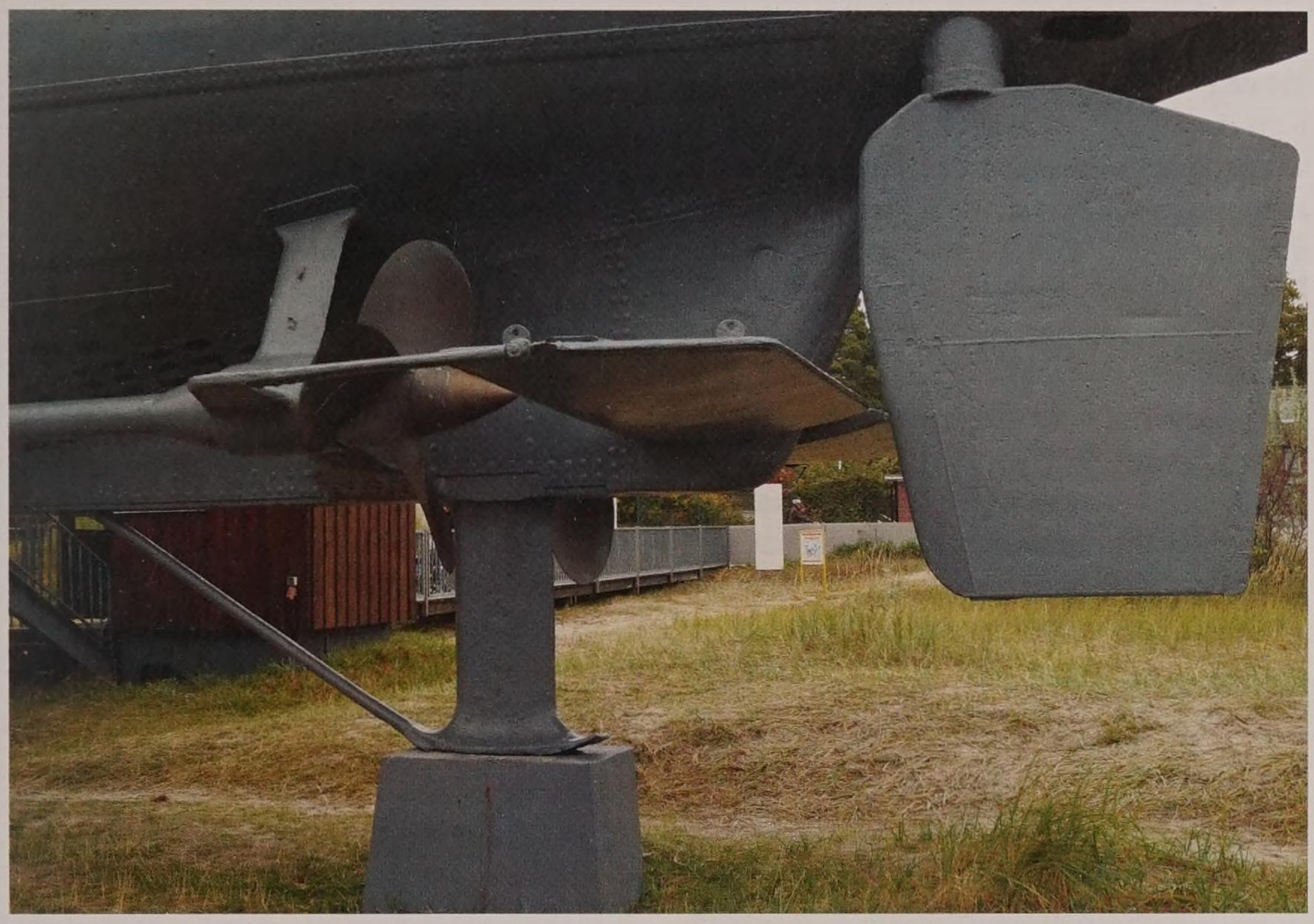
a waiting enemy. To get around the problem, U-boats avoided the nets by sailing around the Scottish coast to reach the Atlantic.

Serrated net-cutters were installed on top of and directly beneath the bows of Type VII boats to cut through anti-submarine netting constructed with diagonal mesh made from 4mm-thick plate measuring 8ft on each side and joined together in 300ft lengths. The nets were tailored to fit the depth of the water where they were installed, often at the mouths of rivers or at ports. They were secured to buoys on the surface and hung down to the bottom like curtains. Anti-submarine nets were highly effective and by 1941 the Kriegsmarine had removed the net-cutters from all U-boats, regarding them as a useless fixture.

Type VII **rudder installations** included two identical rudder planes parallel to each other, forward dive planes, aft dive planes, a plane drive, steering stations and steering lines. To keep the driving force low, all steering planes were built as displacement, balanced rudders made from watertight plating on both sides with stiffeners fitted between their plates. A skeg – a sternward extension of the keel – was fitted to protect the main rudder from hitting the sea bottom and from it two arms led to both rudders and was attached to rudder pins. To prevent entanglement with enemy anti-submarine netting, all linkages were made smooth and faces rounded. To avoid corrosion, steering planes were provided with zinc protection plates.

The main rudder could be used either electrically or be manually driven by means of a vertical intermediate shaft which passed through the pressure hull and was driven by 'worm gear' – an arrangement in which a gear in the form of a screw meshes with a worm wheel. The maximum deflection of the main rudder and forward and aft dive planes was limited electrically by means of a limit switch and mechanically by a limit stop.

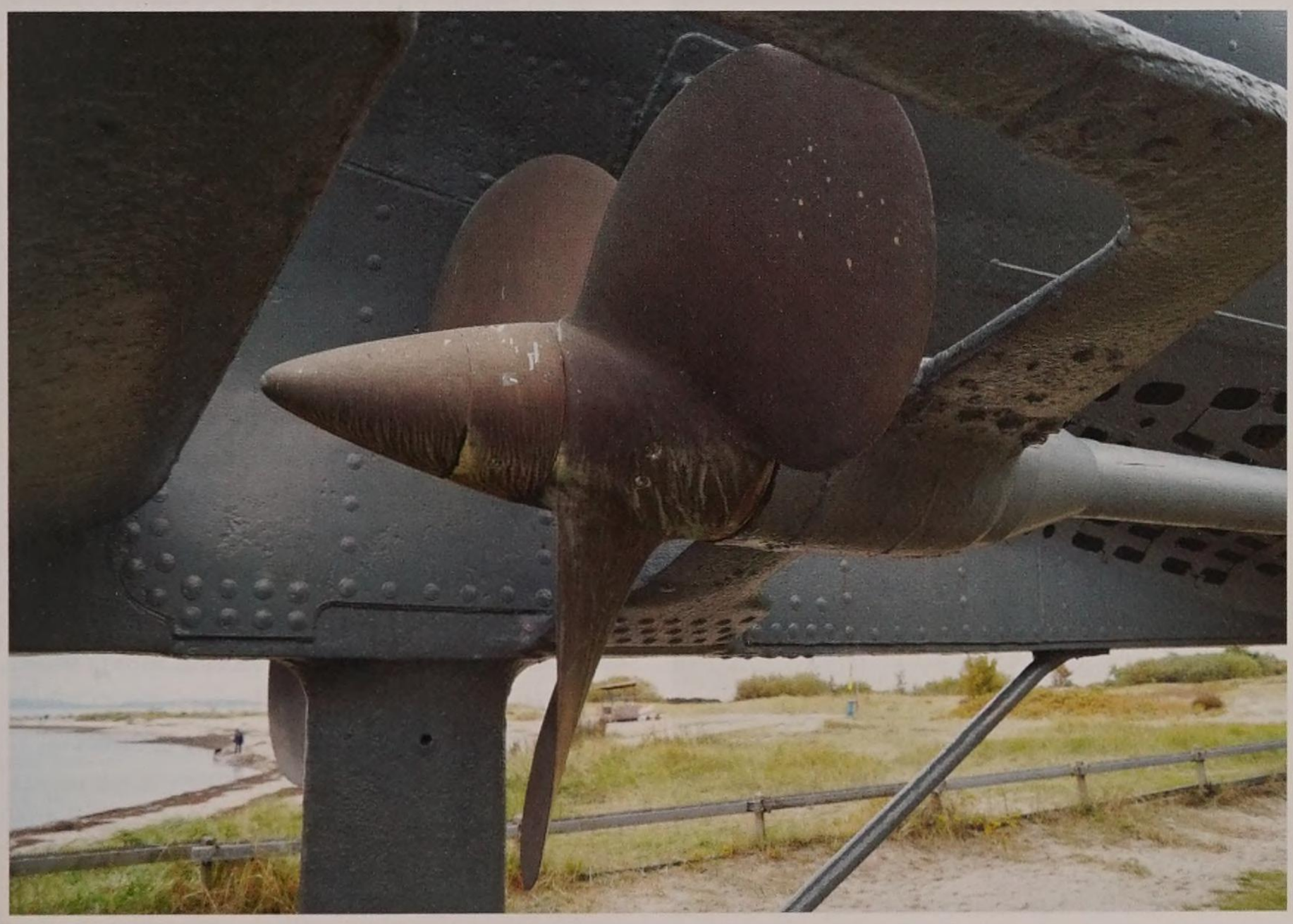
LEFT Twin rudder installation.



LEFT Port rudder, propeller, hydroplane and skeg.

Forward and aft dive planes were mounted on common shafts. Maximum deflection of the forward planes was 30° up and 30° down, and for aft hydroplanes 25° up and 35° down. An electric motor-driven spindle moved a pushing rod in or out and through the connection with the rudder shaft level deflecting the dive planes. The aft dive planes had an area of 2.25m² and the forward dive planes covered an area of 2.4m².

Type VII class **propellers** were made from a single piece and mounted on to the shaft's cone by a key and nut. To ensure better water



LEFT Starboard propeller.

flow and to protect the propeller mounting, the aft end of the screw hub was secured by a cowling cover, which also locked it to an attaching nut. The area between the shaft's support and the propeller hub was covered by a metal sheet to protect it from coming into contact with foreign objects. The propeller was 1,620mm in diameter and 1,540mm in pitch, covering a total area of 0.93m² over a 0.81m² projected area and covered in special grade B casting brass.

Type VII boats came with five **ballast tanks**, giving them the buoyancy necessary for surface patrols. Tanks 1 and 5 were located at the aft and forward ends of the outer shell, while main ballast tank 3 was located inside the pressure hull beneath the control room floor. Tank 5 was sickle shaped and strengthened with perforated bulkheads. On the port and starboard sides there were three rectangular and outward opening floor valves, which were operated by means of four linkage rods from the control room. Venting of main ballast tank 3 took place through two separate port and starboard pressure-proof trunks near the aft part of the control room, which were then led through the port and starboard regulating fuel oil tanks. These trunks were provided with independently operated vent valves.

BELOW Starboard main ballast and fuel tanks.

Main ballast and reserve fuel oil tanks 2 and 4 (port and starboard) were located in the outer shell. Flood valves for these tanks were operated from inside the boat and opened inwards. Venting of tanks took place through trunks. Trunks from starboard tanks 2 and 4 led to a common vent valve at the starboard side. A similar arrangement was made for port tanks.

Main ballast and reserve fuel oil tanks were fitted at their aft end with a residual air vent installation. Two cut-off valves were installed at the joints with the tanks and two further vent valves port and starboard.

Main ballast tanks were blown with compressed air controlled from a blowing distributor located on the starboard side of the control room. Blowing took place until the boat achieved sufficient buoyancy to allow the crew to safely open the conning tower hatch. Exhaust gas from the diesel engines was used to blow residual water from the ballast tanks. Exhaust gases were fed through the main port and starboard blowing valves to an exhaust gas-blowing manifold located outside the pressure hull and on the starboard side over the control room.

The aft and forward part of the outer shell was constructed as stern and bow buoyancy tanks used to dampen longitudinal pitching of the boat. Both tanks had flood slits with one vent to each valve.

Regulating tanks were provided to compensate for changes of weight caused by consumption of provisions, fuel oil, munitions, different numbers of crew and buoyancy or changes caused by leakage. These were

located on both sides of the pressure hull near the control room and were pressure tight. Water levels in the tanks were readable by means of level indicators or an air pressure gauge. Regulating tanks were connected to the drainage installation in the control room and could be drained by the main drain pump, auxiliary drain and trim pump as well as by compressed air.

Regulating **reserve fuel oil tanks** were also located port and starboard outside the pressure hull between main ballast and reserve fuel oil and regulating tanks. They were pressure tight and had the same flood and drain ability as regulating tanks, except for using compressed air for blowing. The amount of water inside the tanks was measured by an air pressure gauge. Tanks could be used either as regulating or fuel oil tanks. When used for fuel oil, they were connected with low pressure air installation and with fuel oil delivery lines. Tanks were fitted with their own venting and sounding lines.

Even small changes in weight displacement in the longitudinal axis could cause trim changes when the boat submerged. To compensate for changes in trim during torpedo and mine launching, a trimming installation was provided. In the forward and aft torpedo rooms were two trim tanks, located 41.6m apart. They were connected by a pipeline with a water meter, trim line valve and trim controller. Trimming took place by means of compressed air or the auxiliary drain and trim pump.

The **torpedo compensating tanks** were flooded to compensate for the weight of a launched torpedo or mine. Two tanks were located in the forward torpedo room and another in the E-motor room. Each compensating tank had its own sounding pipe and could be flooded with seawater connected to the draining installation. Torpedo compensating tank 2 in the forward torpedo room was also connected with a hand wash water pump in the forward WC.

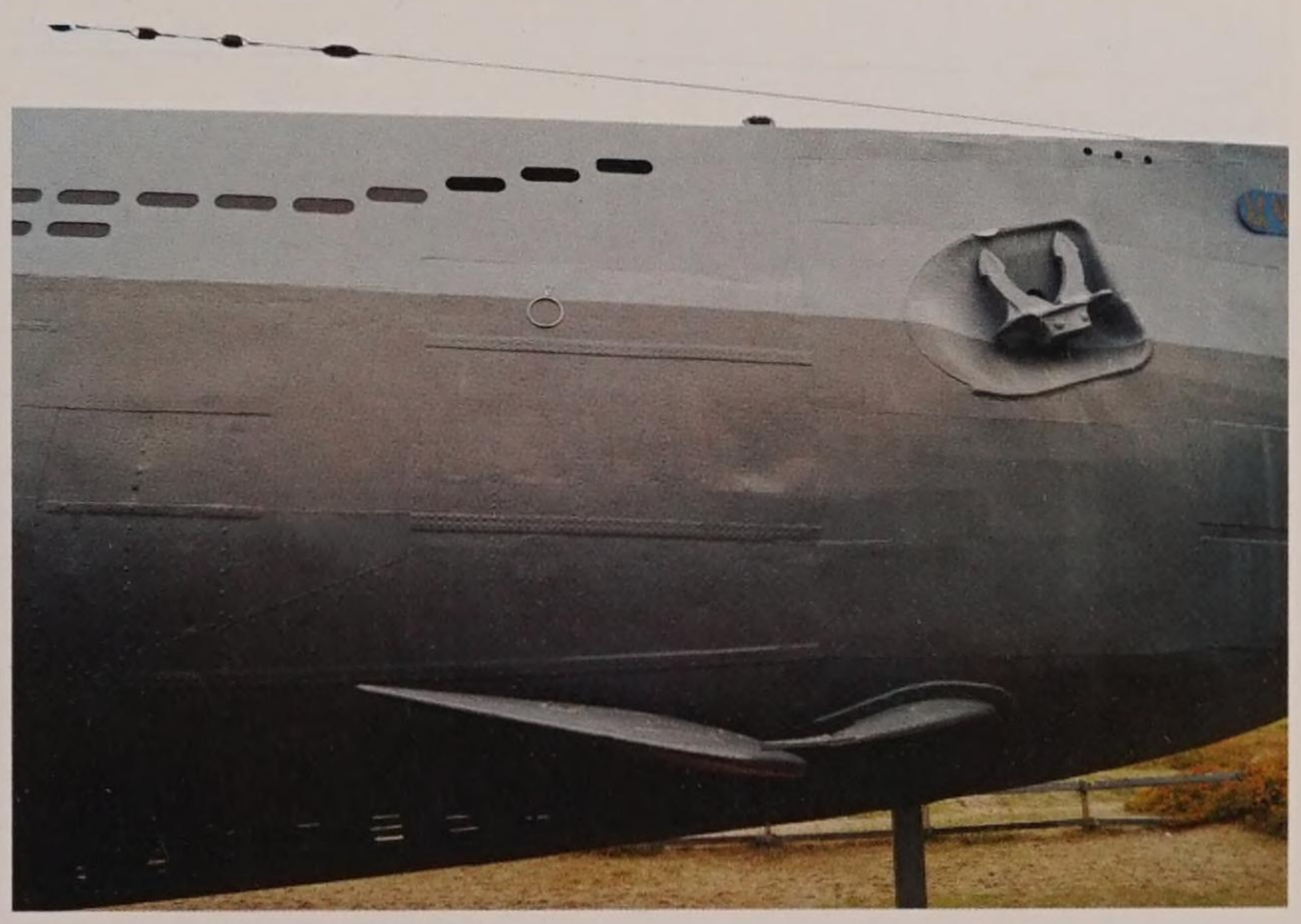
Bow and stern hydroplanes, which projected from the sides of the boat, were used to 'fly' the submarine through the water. By varying the angle on these planes, the boat was made to rise, fall or remain at the same depth as it moved forward. Since the boat was normally trimmed to be slightly positively buoyant, hydroplanes were used to hold it down as a safety precaution. If all power was lost, it was preferable to slowly rise to the surface and not sink.

The stern planes were used to keep the boat at the desired angle. While diving, the upper deck also became a planing surface, providing an additional downward push.

In Type VII boats, plane operators used small levers to control electric servo motors to move the planes. Wheels were also present in the control room, but were only used if there was a problem with the power mechanism.

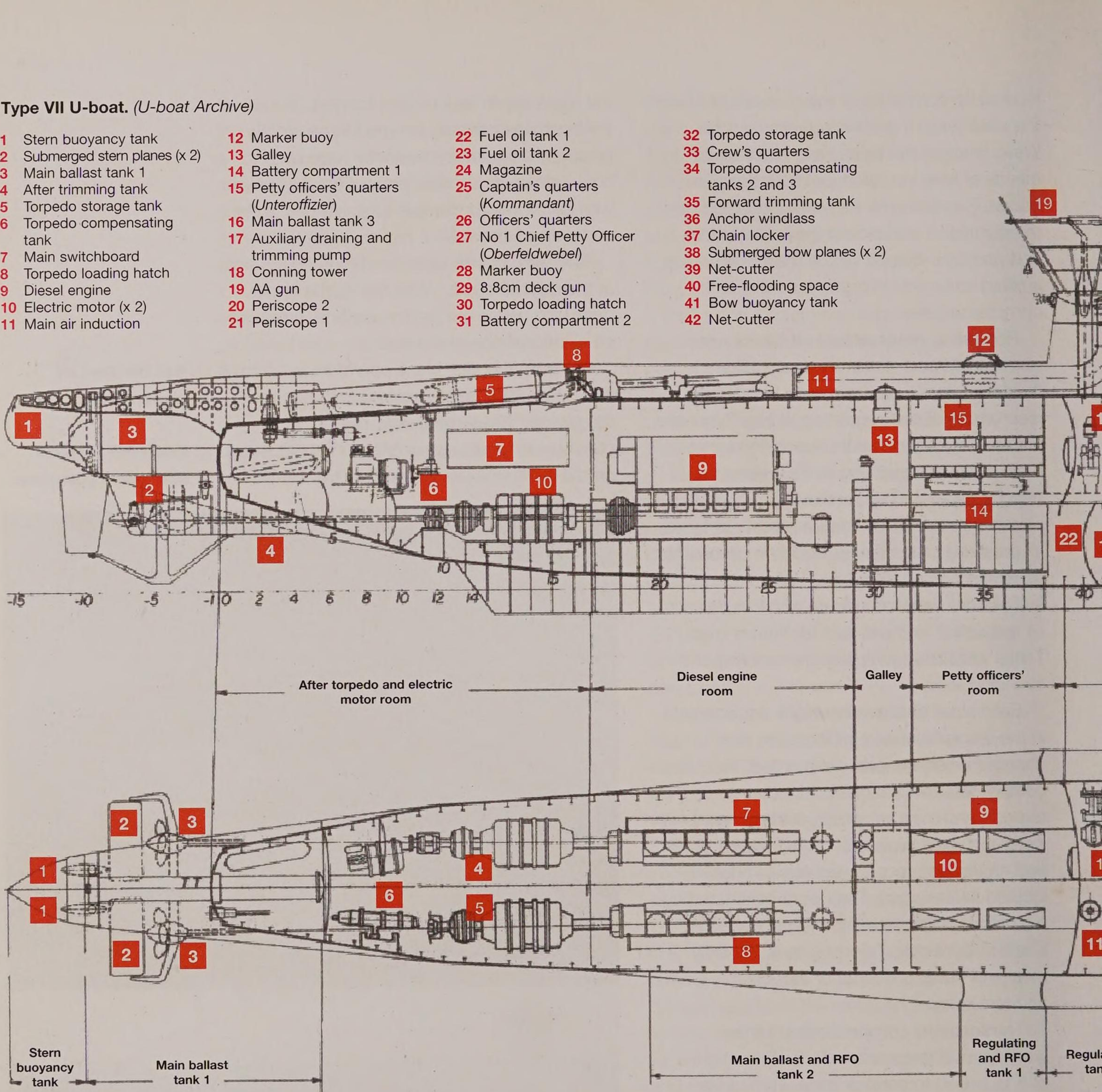
BELOW Port aft hydroplane.

BOTTOM Forward starboard hydroplane.



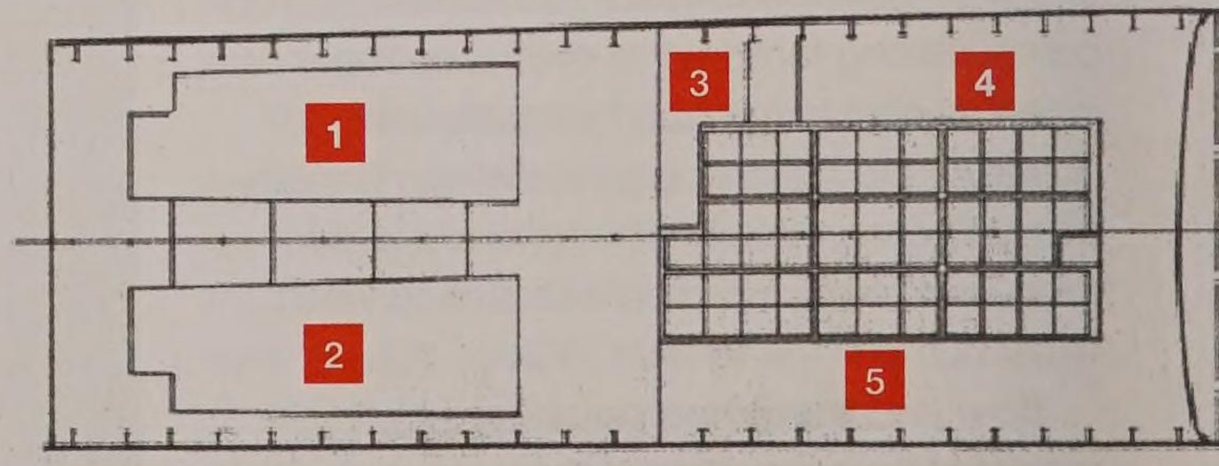
Type VII U-boat. *(U-boat Archive)*

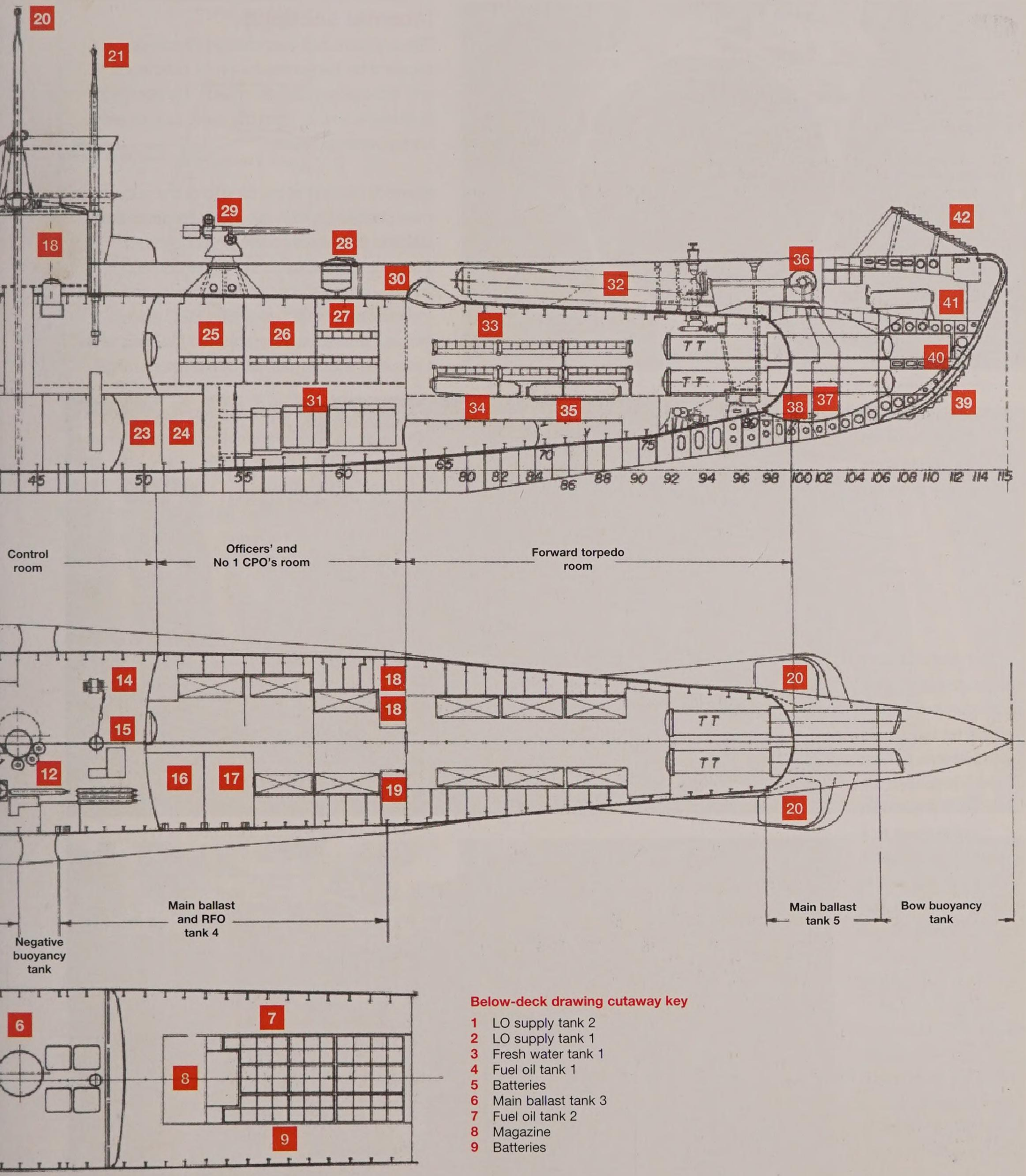
1 Stern buoyancy tank
2 Submerged stern planes (x 2)
3 Main ballast tank 1
4 After trimming tank
5 Torpedo storage tank
6 Torpedo compensating tank
7 Main switchboard
8 Torpedo loading hatch
9 Diesel engine
10 Electric motor (x 2)
11 Main air induction
12 Marker buoy
13 Galley
14 Battery compartment 1
15 Petty officers' quarters (*Unteroffizier*)
16 Main ballast tank 3
17 Auxiliary draining and trimming pump
18 Conning tower
19 AA gun
20 Periscope 2
21 Periscope 1
22 Fuel oil tank 1
23 Fuel oil tank 2
24 Magazine
25 Captain's quarters (*Kommandant*)
26 Officers' quarters
27 No 1 Chief Petty Officer (*Oberfeldwebel*)
28 Marker buoy
29 8.8cm deck gun
30 Torpedo loading hatch
31 Battery compartment 2
32 Torpedo storage tank
33 Crew's quarters
34 Torpedo compensating tanks 2 and 3
35 Forward trimming tank
36 Anchor windlass
37 Chain locker
38 Submerged bow planes (x 2)
39 Net-cutter
40 Free-flooding space
41 Bow buoyancy tank
42 Net-cutter



Plan view drawing cutaway key

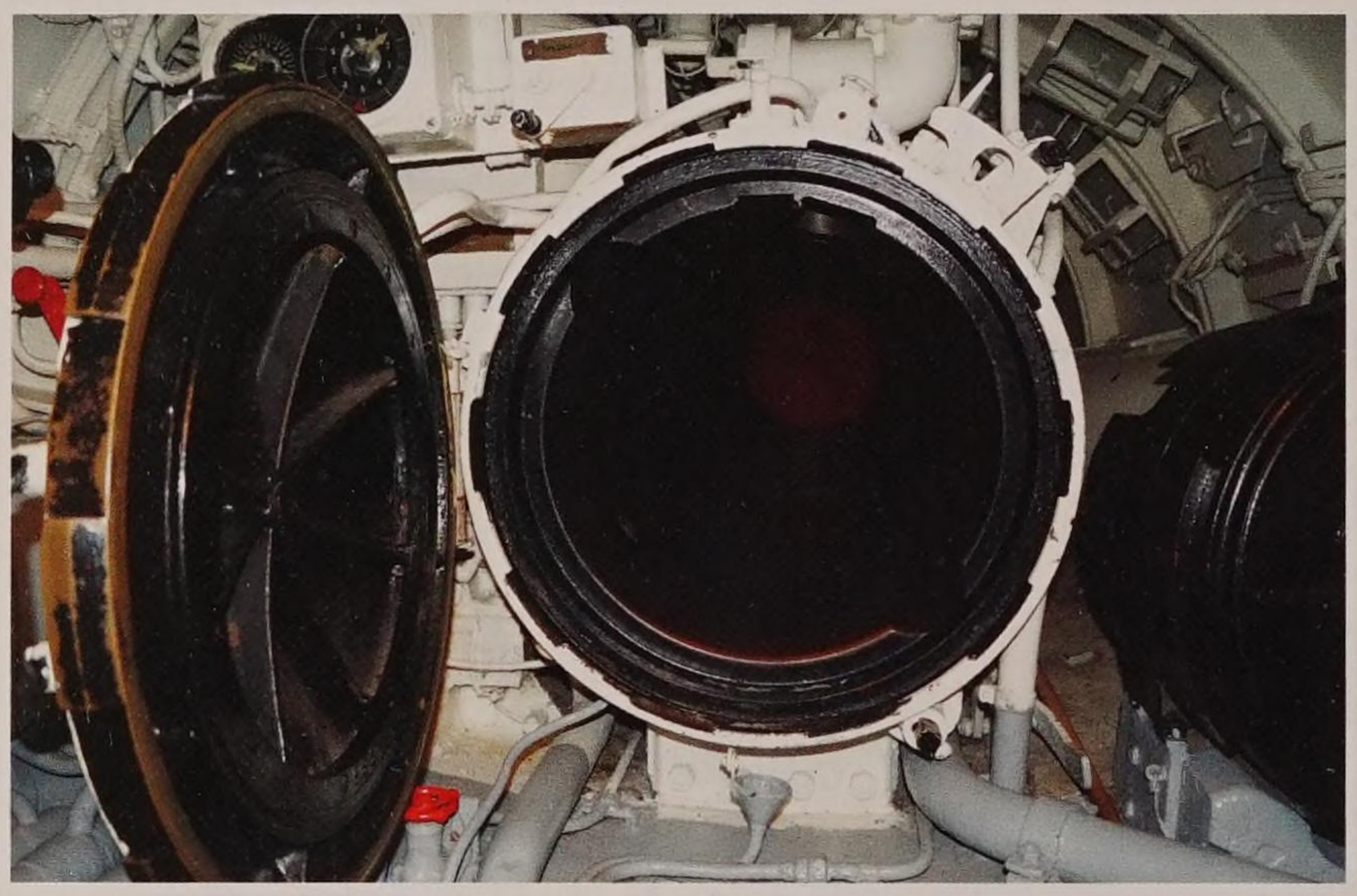
1 Twin rudders
2 Submerged stern planes (x 2)
3 Propeller
4 Electric motor port
5 Electric motor starboard
6 Air compressor (starboard only)
7 Diesel engine port
8 Diesel engine starboard
9 Fuel oil tank 1
10 Gyrocompass
11 Main drainage pump
12 Pressure oil pump
13 Seawater distilling unit
14 Winch
15 Forward periscope
16 Radio room
17 Listening room
18 WC (x 2)
19 Food stores
20 Submerged bow planes (x 2)





Below-deck drawing cutaway key

1 LO supply tank 2
2 LO supply tank 1
3 Fresh water tank 1
4 Fuel oil tank 1
5 Batteries
6 Main ballast tank 3
7 Fuel oil tank 2
8 Magazine
9 Batteries

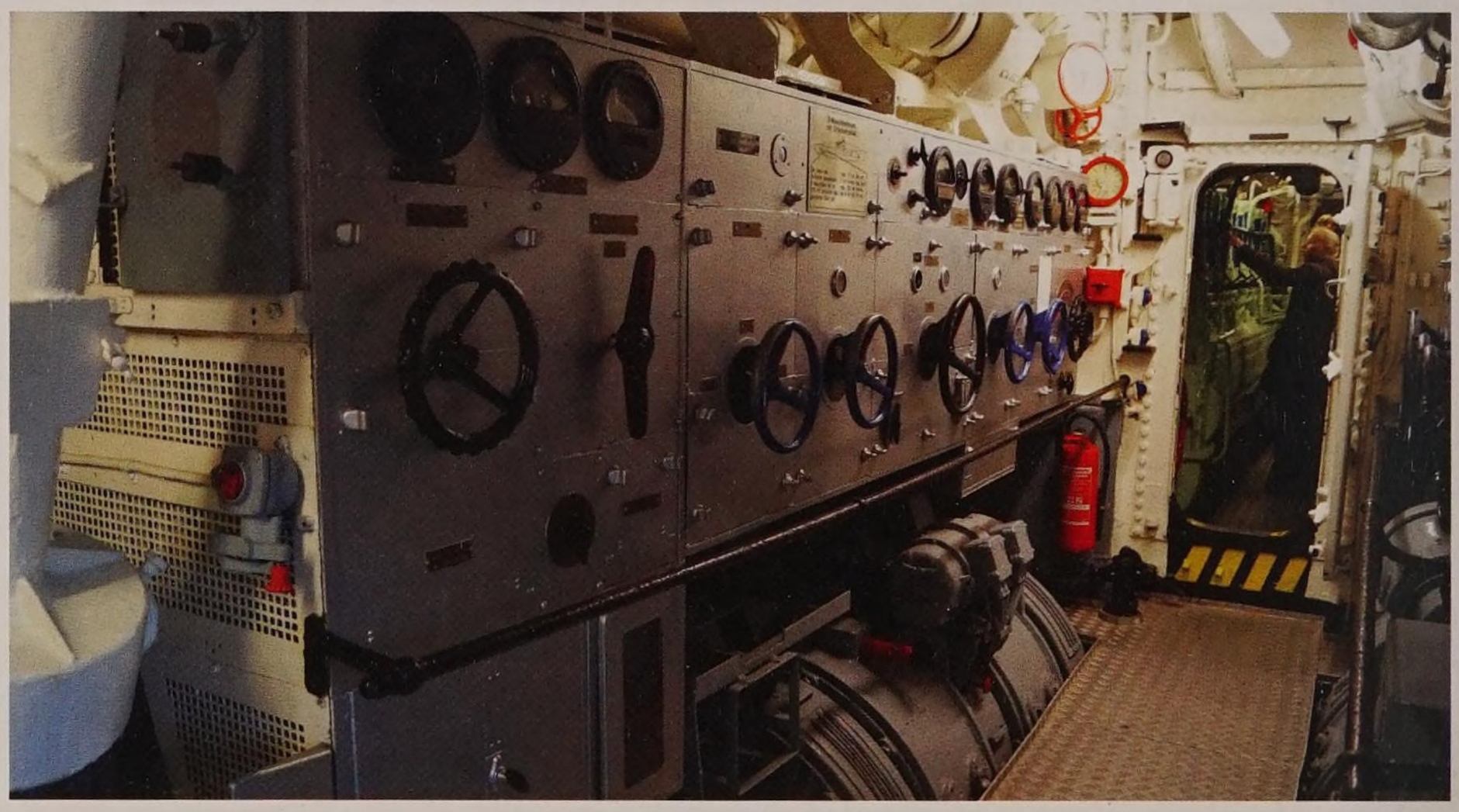


Internal sections

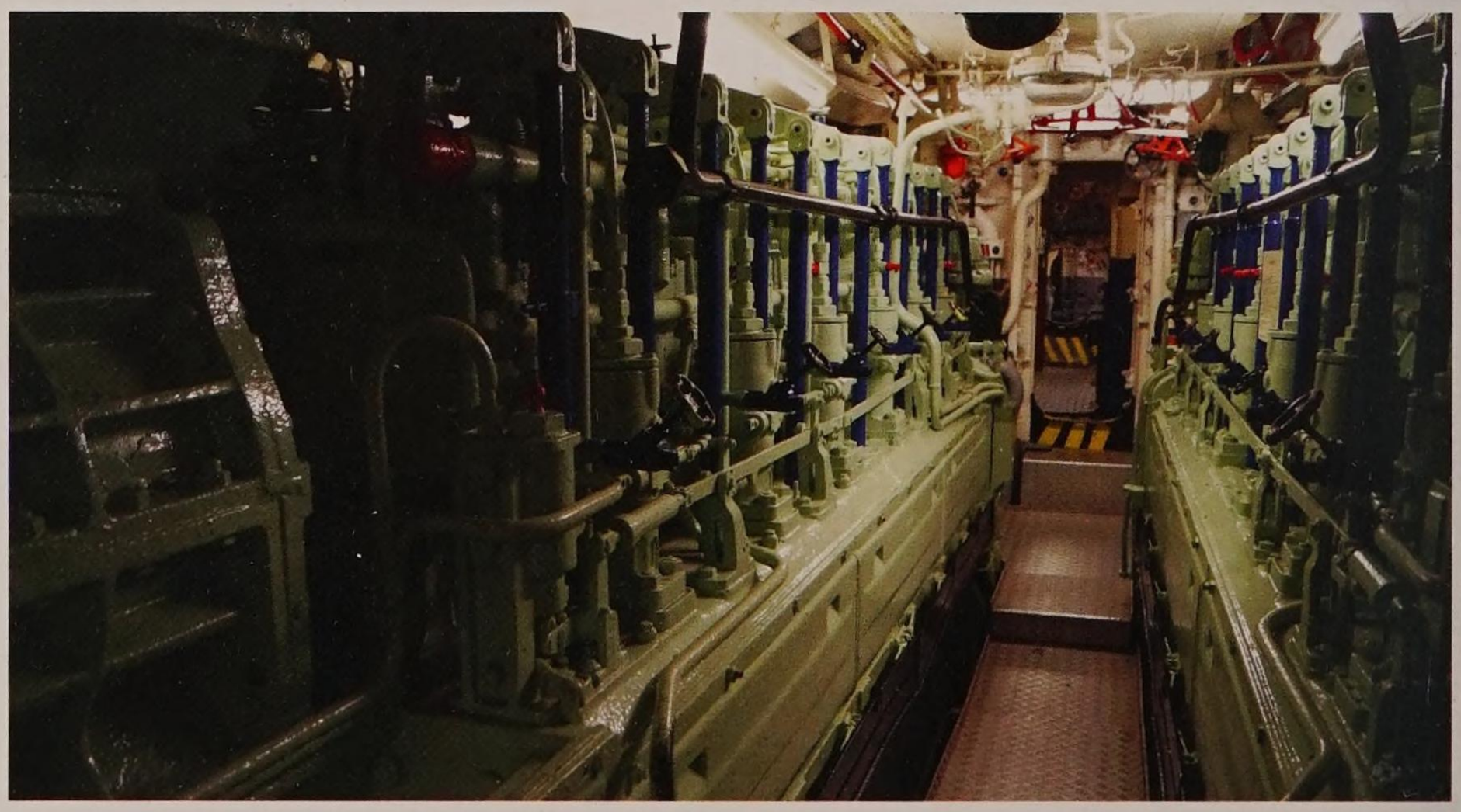
The pressure hull was divided into three sections by two pressure-proof bulkheads and subdivided into six 'rooms' by watertight bulkheads which, from the stern to forward areas, were as follows:

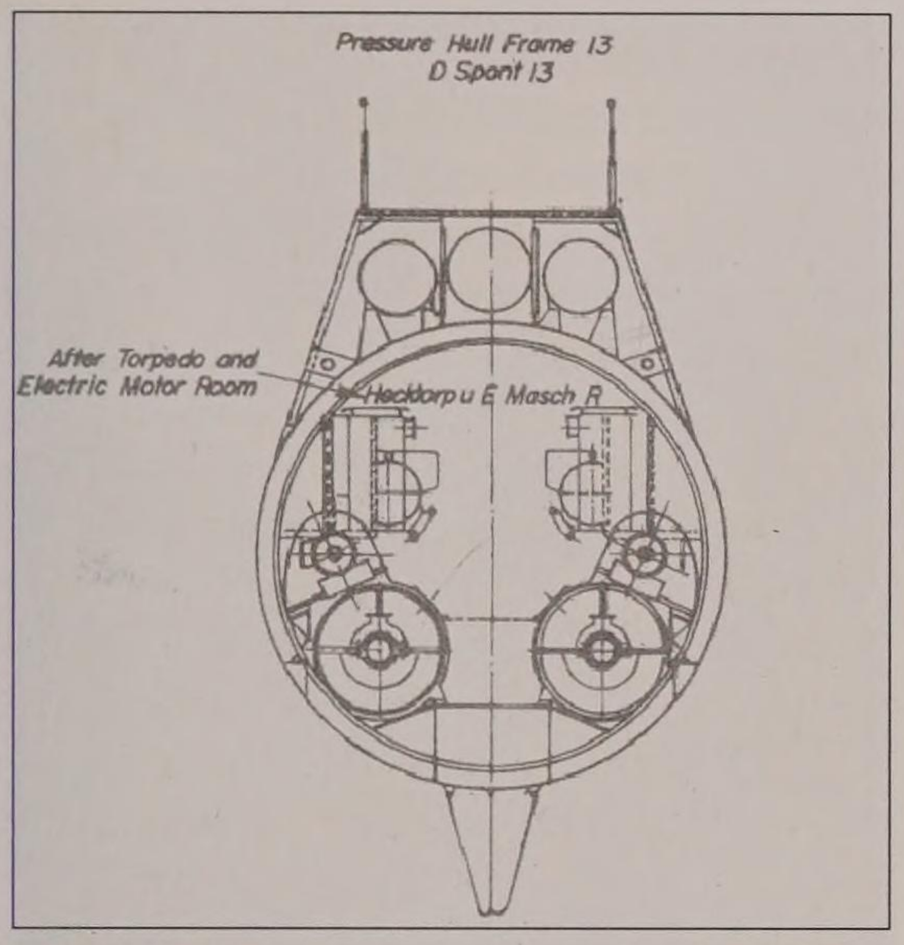
Room 1: Starting at the far end of the submarine, crew passed through the **stern torpedo and electric (E) motor room**, which featured a stern torpedo tube in the aft section and ahead – on both sides of the narrow gangway – control panels for two 375hp BBC electric motors beneath, which propelled the boat while it travelled submerged with a maximum range

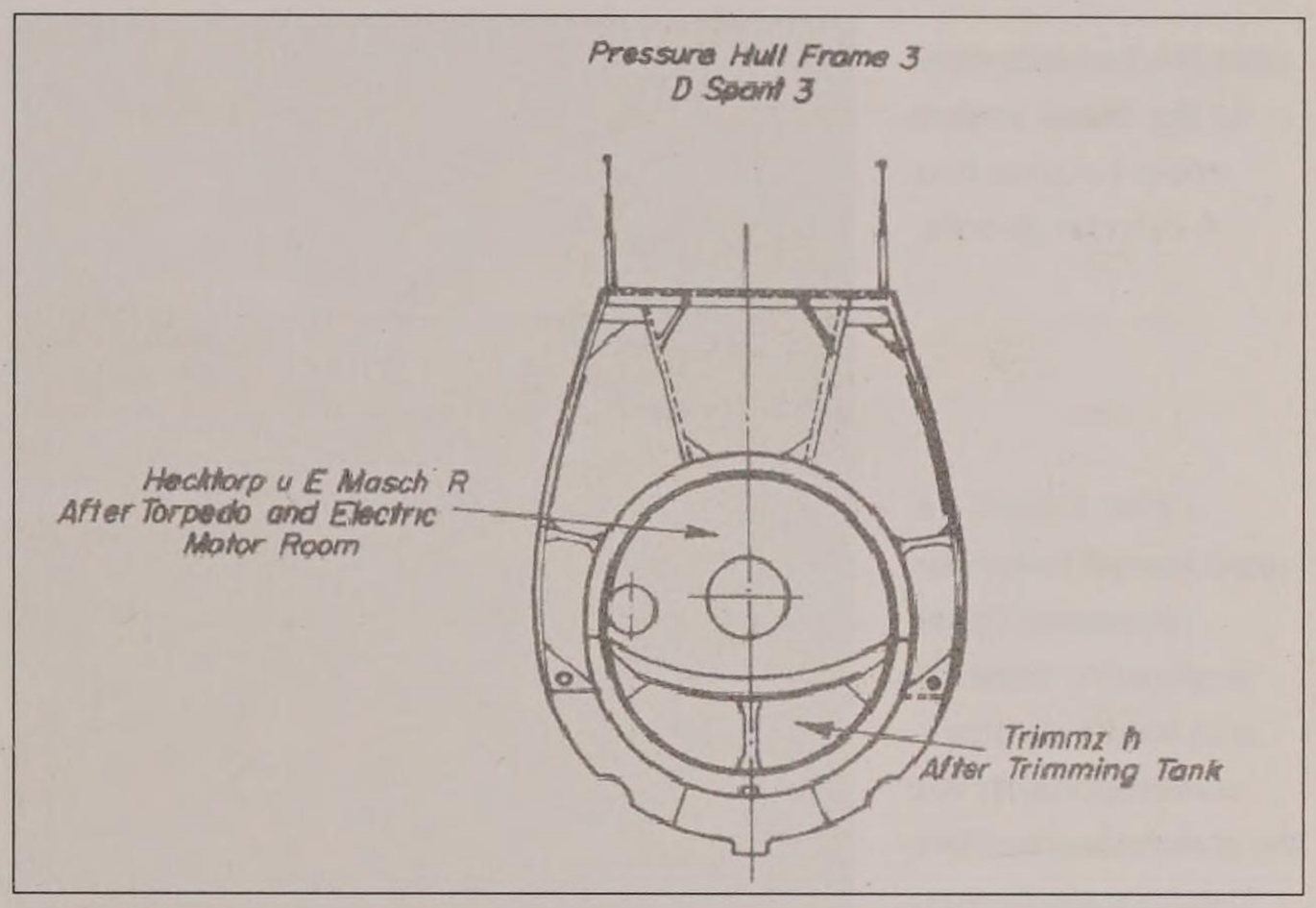
ABOVE Aft torpedo room on U-995 showing the stern torpedo tube.



RIGHT AND BELOW The electric (E) engine room showing control panels for two 375hp BBC electric motors which propelled the boat while it travelled submerged to a maximum range of 130nm at a speed of 2 knots. The electric engines were coupled to the same shaft as the boat's diesel engines. Once the clutch was disengaged and they were freely rotating while diesel engines powered the boat, power was generated to recharge the batteries. The blue vertical rods are the engine valve rocking arms.



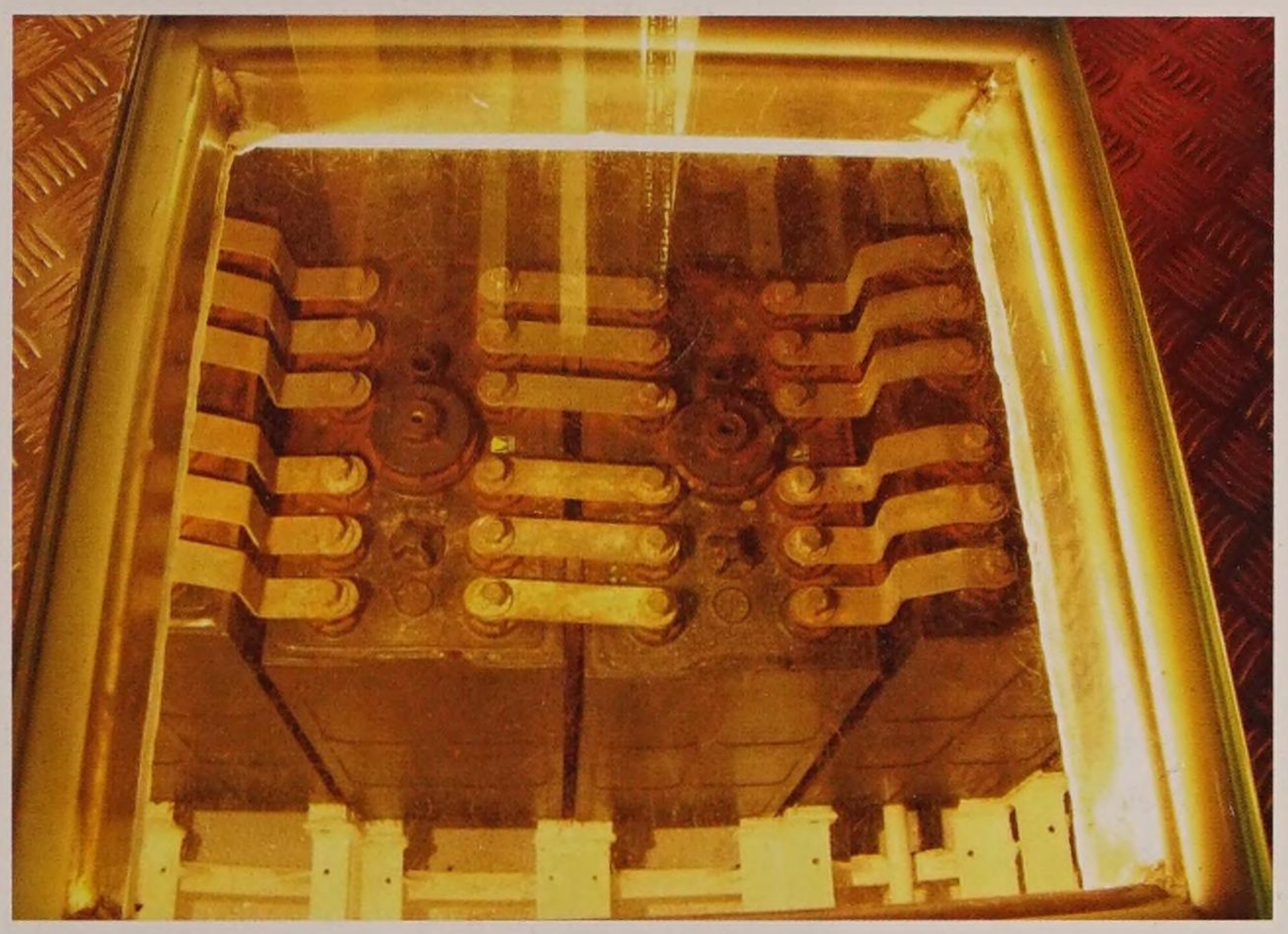




ABOVE Pressure hull cross-section, Frame 13, showing after torpedo room and electric motor room. *(U-boat Archive)*

ABOVE RIGHT Pressure hull cross-section, Frame 3, showing after torpedo room, electric motor room and after trimming tank. *(U-boat Archive)*

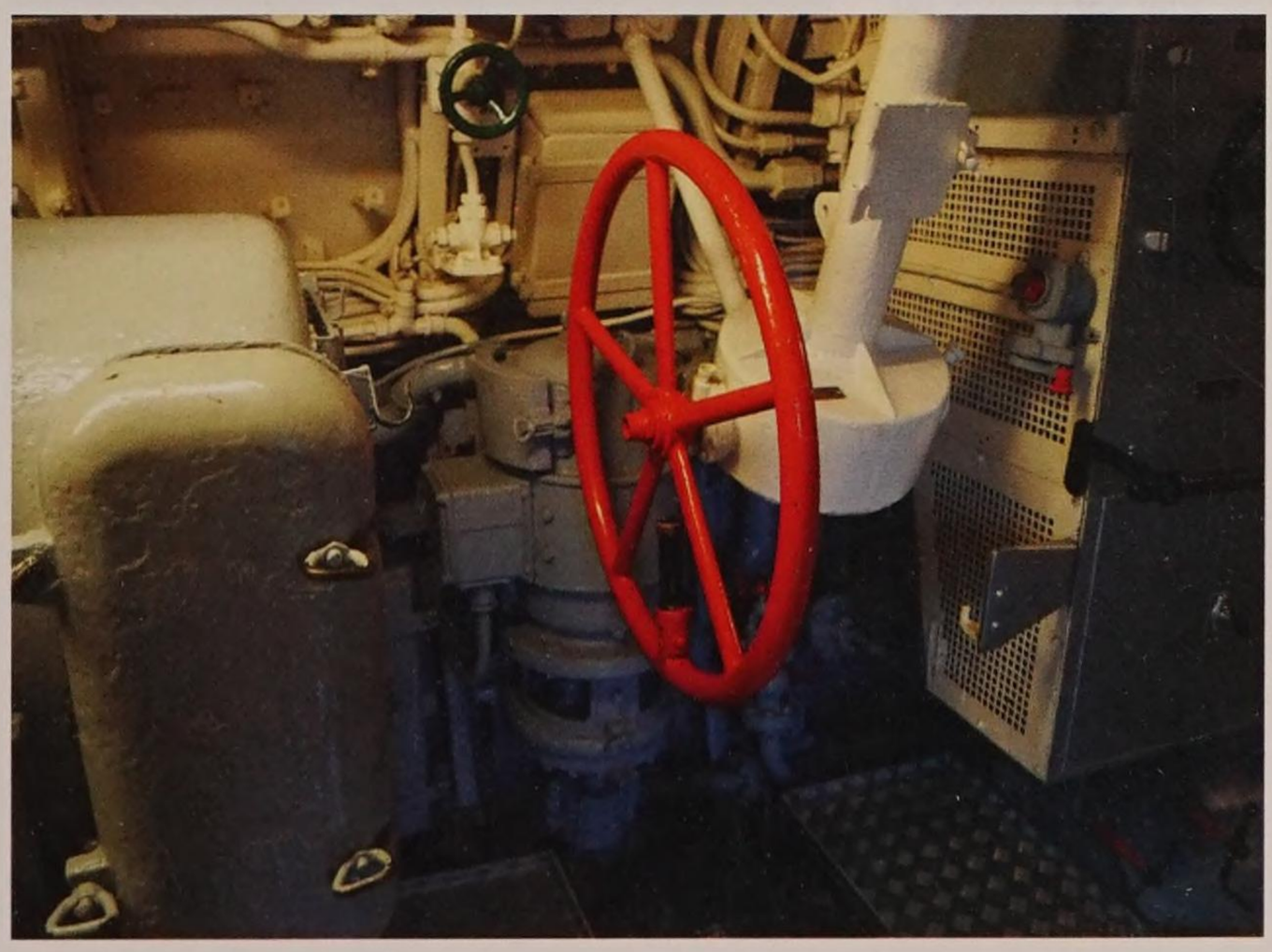
RIGHT Enlarged storage batteries were located beneath deck plates in the NCOs' and officers' messes and provided the boat's auxiliary and main power supply. *(Deutscher Marinebund)*



of 130nm at a speed of 2 knots. The electric engines were coupled to the same shaft as the boat's diesel engines. Once the clutch was disengaged and they were freely rotating while diesel engines powered the boat, power was generated to recharge the batteries.

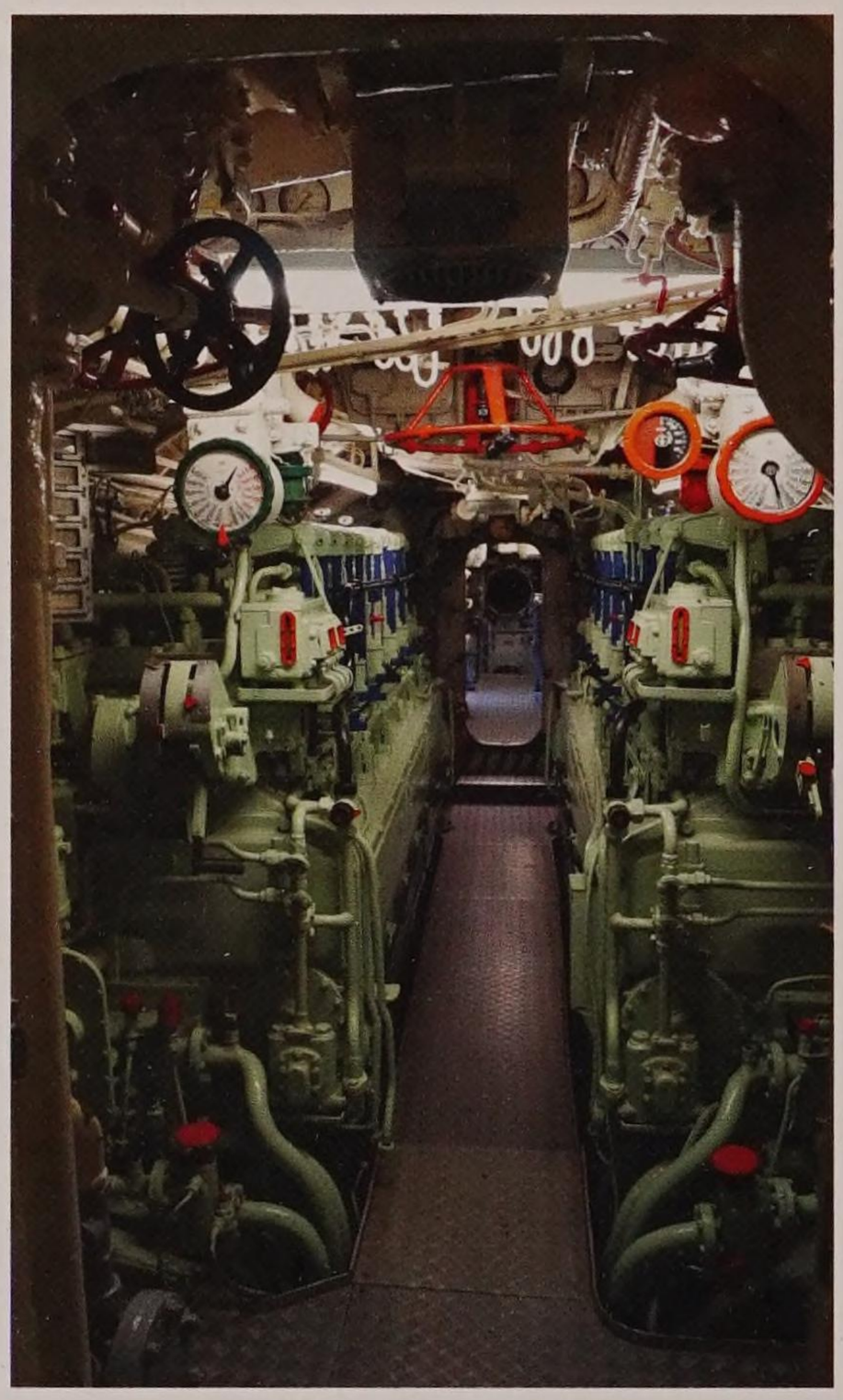
Enlarged **storage batteries** were located beneath deck plates in the NCOs' and officers' messes and were the boats' auxiliary and main power supply. The cells of every battery were set up in six rows on step-shaped iron stands. Over the cells was an extractor duct that took gases into the main exhaust trunk. Each cell was connected to the duct by a rubber tube. Between the single plates of each cell were insulators.

When submerged, U-boats were driven by electric motors using electricity drawn from the



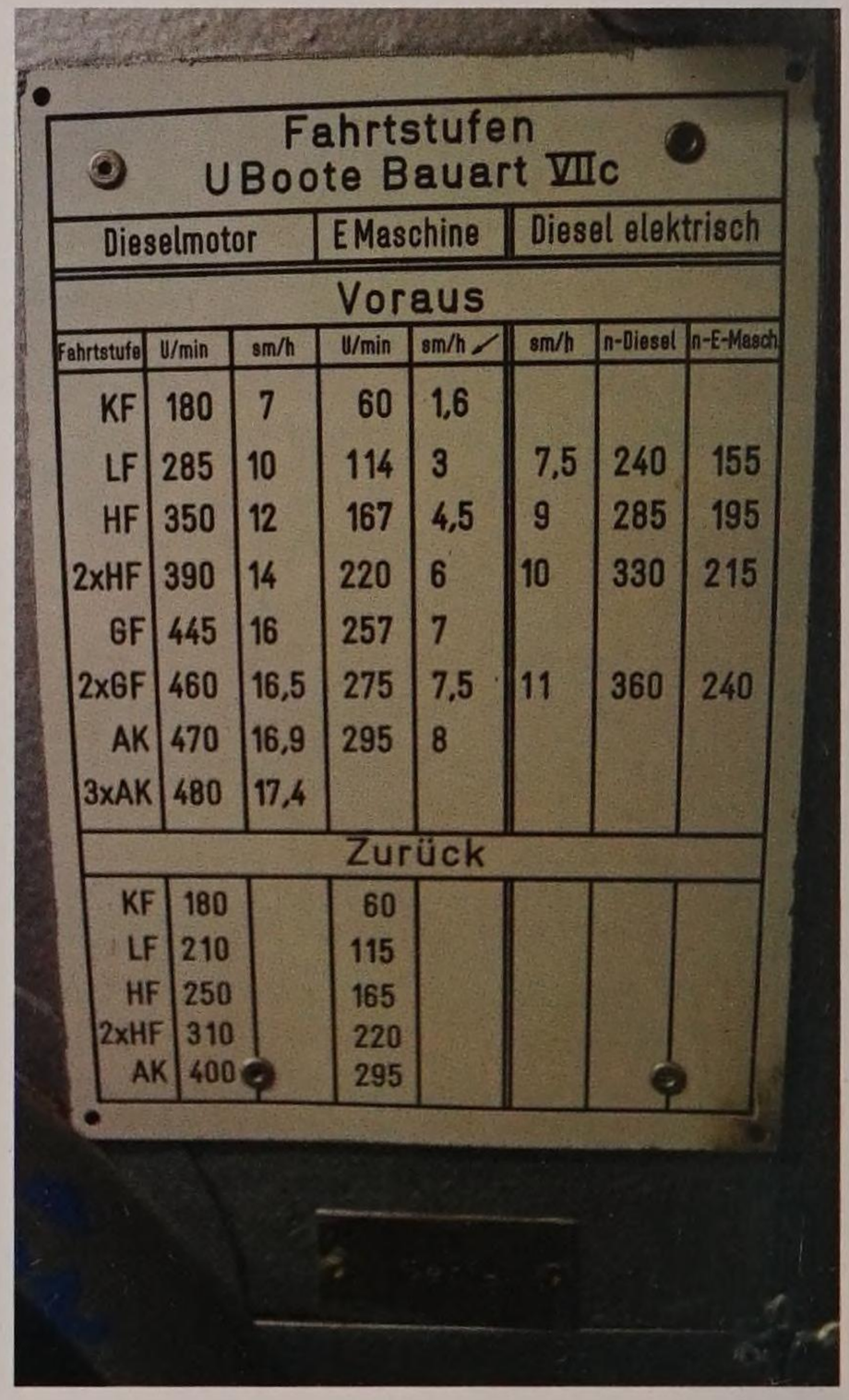
RIGHT The emergency generator located next to the auxiliary generator.

RIGHT Forward view of the diesel engine room housing two 6-cylinder diesels.



FAR RIGHT An experienced *Leitender Ingenieur* (chief engineer) – standing with hands on hips – was responsible for the maintenance of the U-boat's machinery, including the engines, motors, batteries and other mechanical systems. This officer also set the demolition charges in the event of the boat having to be scuttled. *(Through Their Eyes)*

RIGHT Looking back into the electric (E) motor room and aft torpedo room from the diesel (D) motor room.


Fahrtstufen
UBoote Bauart VIIc
Dieselmotor
E Maschine
Diesel elektrisch
Voraus
Fahrtstufe | U/min | sm/h | U/min | sm/h | sm/h | n-Diesel | n-E-Masch
KF | 180 | 7 | 60 | 1,6
LF | 285 | 10 | 114 | 3 | 7,5 | 240 | 155
HF | 350 | 12 | 167 | 4,5 | 9 | 285 | 195
2xHF | 390 | 14 | 220 | 6 | 10 | 330 | 215
GF | 445 | 16 | 257 | 7
2xGF | 460 | 16,5 | 275 | 7,5 | 11 | 360 | 240
AK | 470 | 16,9 | 295 | 8
3xAK | 480 | 17,4
Zurück
KF | 180 | 60
LF | 210 | 115
HF | 250 | 165
2xHF | 310 | 220
AK | 400 | 295

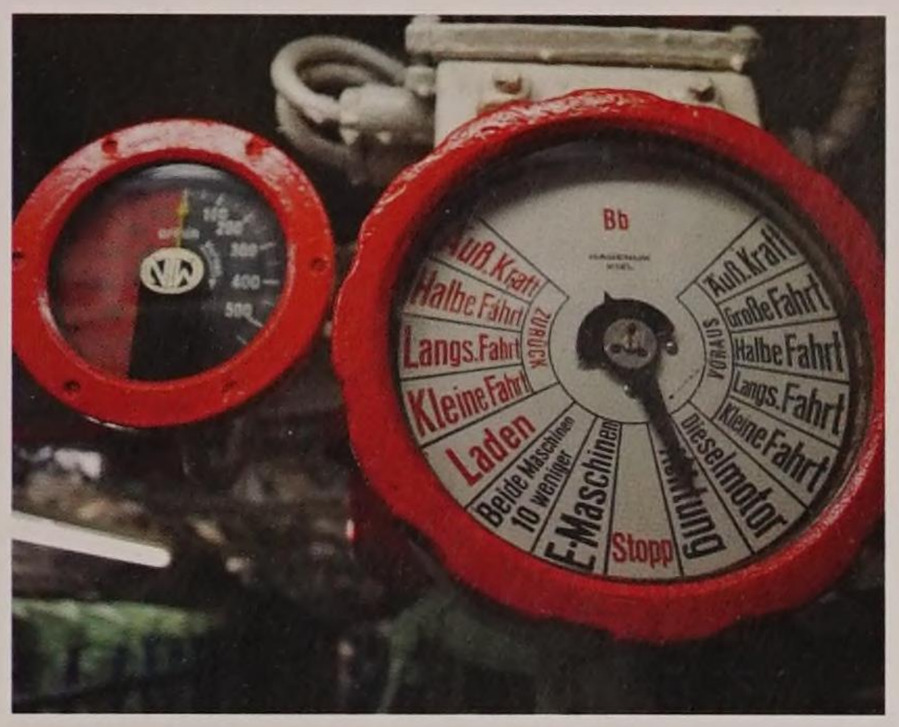
FAR RIGHT A chart showing the boat's attained speed under different dive positions.

batteries. When these became depleted, they needed to be recharged. This was undertaken by travelling on the surface, or while snorkelling at periscope depth. Diesel engines were used to turn the electric motors so that they acted as dynamos (generators) to recharge depleted batteries. For rapid recharge, both diesel engines were clutched on to the electric motors.

On the port side, just aft of the electric switchboard, was the emergency steering control. In the event of rudder failure, the boat could be manually steered from here.

Room 2: A metal doorway measuring 6.7m wide by 17.37m high led to the **diesel (D) engine room**, home to two supercharged 6-cylinder Type Maschinenfabrik Augsburg-Nürnberg (MAN) M6 V40/46 diesel engines, each developing 1,160bhp and with forced induction by a Büchi supercharger which allowed the boat to achieve a maximum speed of 17.6 knots on the surface. The engines were single-acting four-cycle with fuel spray injection and supercharging. The engines were reversible by means of compressed air.

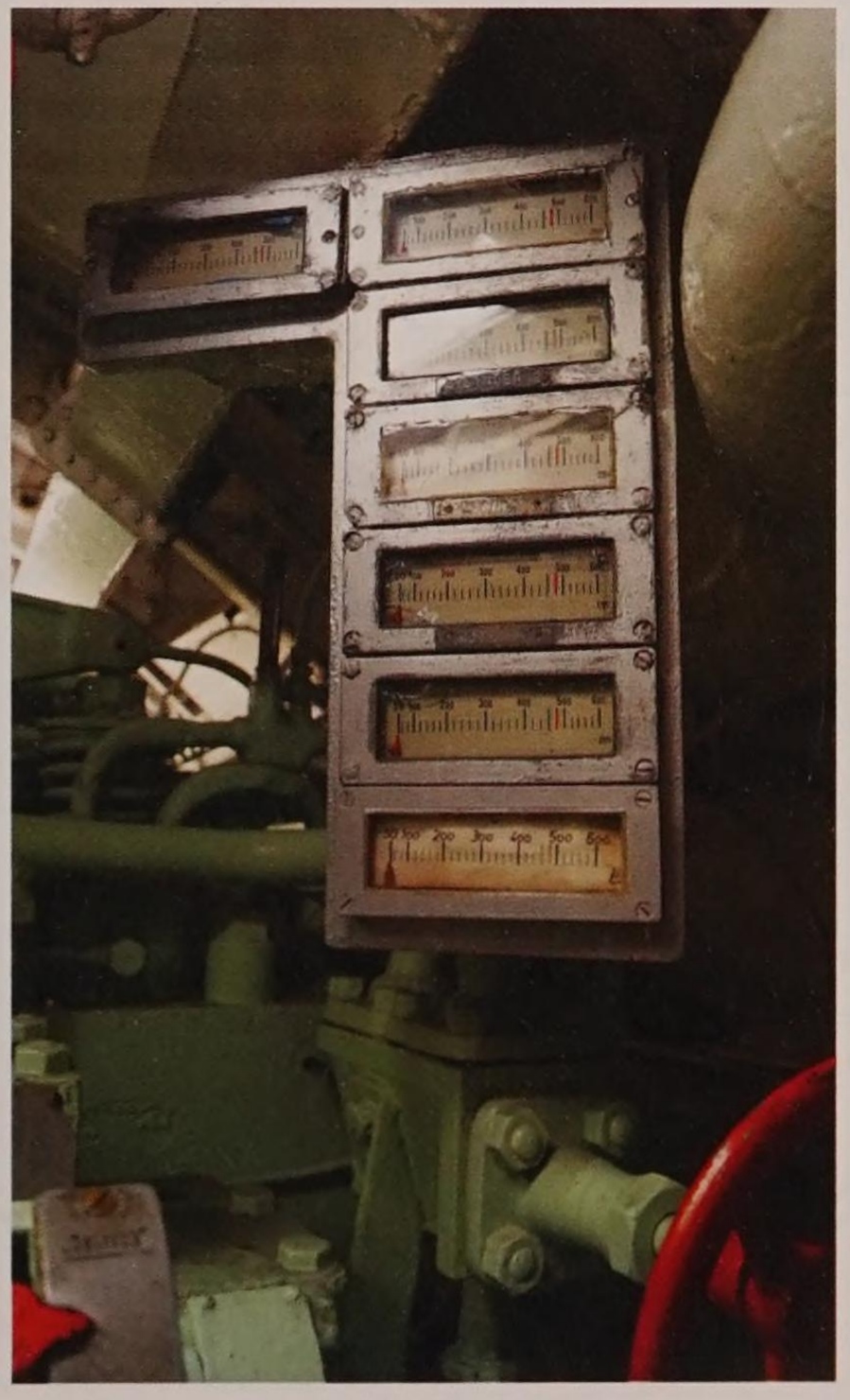
Since Type VII U-boats were submersibles



LEFT Engine telegraph dial.

LEFT The rudder position indicator, located next to the emergency steering control point.

FAR LEFT The engine room wheel used to control the air intake tank.



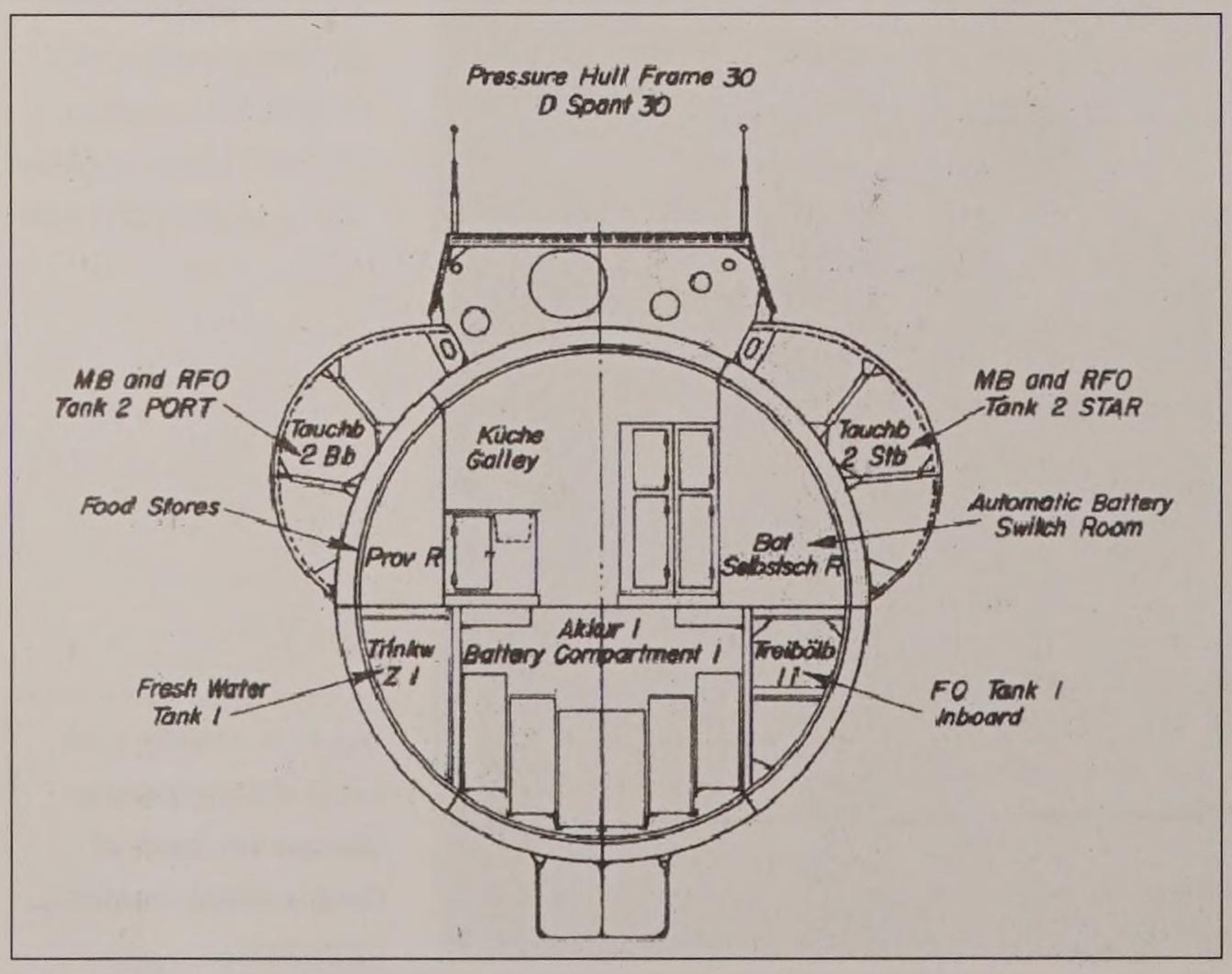
LEFT Temperature gauges for each of the six diesel engine cylinders.

RIGHT A single cook working in a Type VIIC U-boat had to prepare four daily meals for a crew of up to 50 men in a tiny galley housing a small electric stove measuring 91cm wide by 35cm deep and containing three electric hotplate elements and an oven.

FAR RIGHT In the galley a drinking water filter was located above a sink with taps for both fresh and salt water.

BELOW Pressure hull cross-section, Frame 30, showing galley, food stores, fresh water tanks, battery compartment and main ballast tanks. *(U-boat Archive)*

rather than true submarines, the diesel engines served as the main propulsion. Also found here was a pair of starting air flasks and two oxygen flasks. Underfloor was the lubricating oil supply tanks and tanks for collecting lubricating and fuel oils.



The diesel engines were mounted on to robust foundations, which almost completely filled the engine room space with only a narrow access passageway allowing movement through the compartment.

Room 3: Passing through another metal doorway brought crews to the tiny **galley** where the cook prepared four daily meals for a crew of up to 50 men. This was undertaken in a narrow space using a small electric stove measuring 91cm wide by 35cm deep, featuring three electric hotplate elements and an oven. Opposite was a metal sink with four taps – two for hot and cold fresh water and a further two providing hot and cold seawater for washing dishes and cutlery. When not used as a sink, a cover was placed over the top to provide a food preparation surface measuring 83cm by 45cm. A hatch in the overhead galley passage allowed provisions to be loaded on board and stowed wherever space was available.

Room 3 also housed the **petty officers' (non-commissioned officers') mess**, including eight narrow bunks. Since there were more men on board a U-boat than bunks

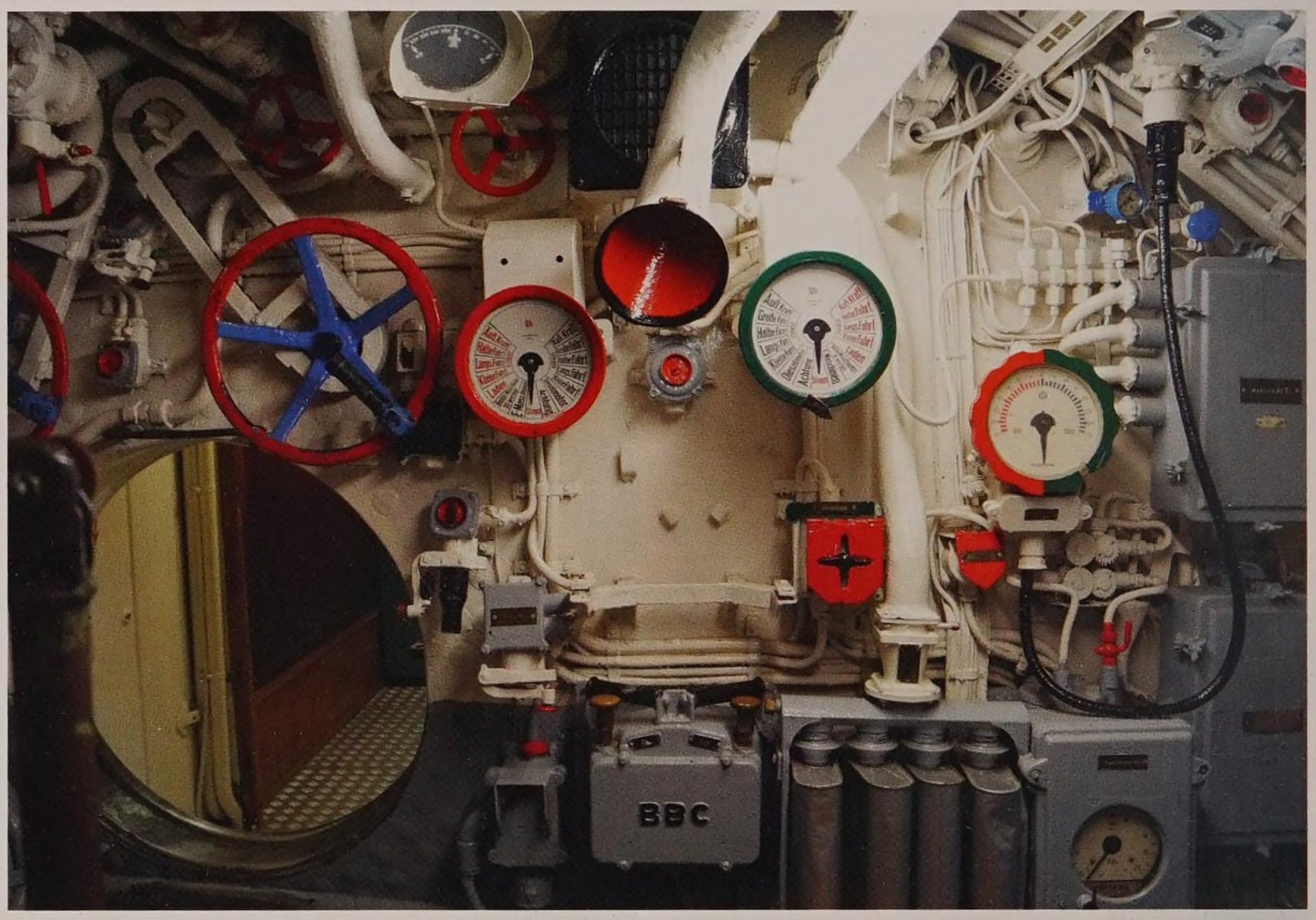
available, two men usually shared one bunk at different times of the day. Although this did not add much to the comfort of life on board the boat, it was not much of a problem since U-boat patrols followed the two-watch system, whereby one-half of the crew were on watch while the other was 'watch below' and sleeping. Due to the lack of privacy, however, sleep deprivation, noise, heat and constant fear of enemy attack, U-boat crews were under permanent mental stress, which made serving on a submarine physically and mentally arduous.

FAR LEFT A hatch leading from the main deck down to the galley and used for loading provisions, which were then stored in all parts of the U-boat.

LEFT The passageway running the entire length of the submarine passed the bunks of sleeping petty officers.

FAR LEFT The petty officers' living quarters. Two men each shared a bunk and while one was on duty, the other slept.

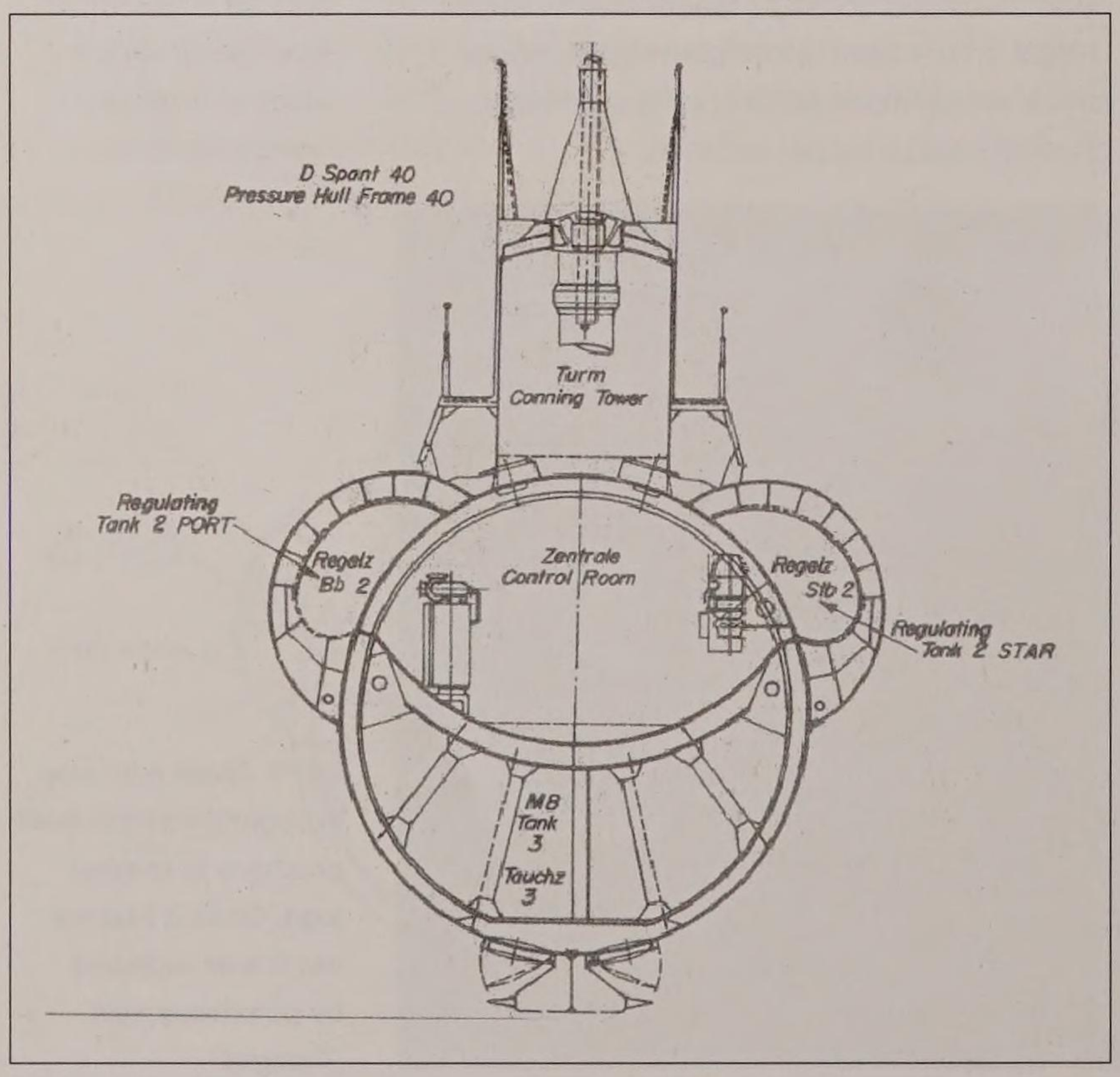
LEFT Fresh milk was brought on to a U-boat on shore in enamel jugs. Once it had run out it was replaced by powdered milk. *(Triangle)*



RIGHT The forward section of the control room. The round pressure hatch (left) leads to the commander's private accommodation area, the observation periscope, helmsman and planesman positions, access to the conning tower and the navigator's table.

BELOW **Pressure hull cross-section, Frame 40, showing control room, conning tower, main ballast and regulating tanks.** *(U-boat Archive)*

Also in this section was one of the boat's two **WCs** – or 'heads' – but this one was taken out of service in order to stow provisions. Another WC was located further along the gangway. Here, too, was an automatic battery switch, a refrigeration plant and a high-pressure air bank.



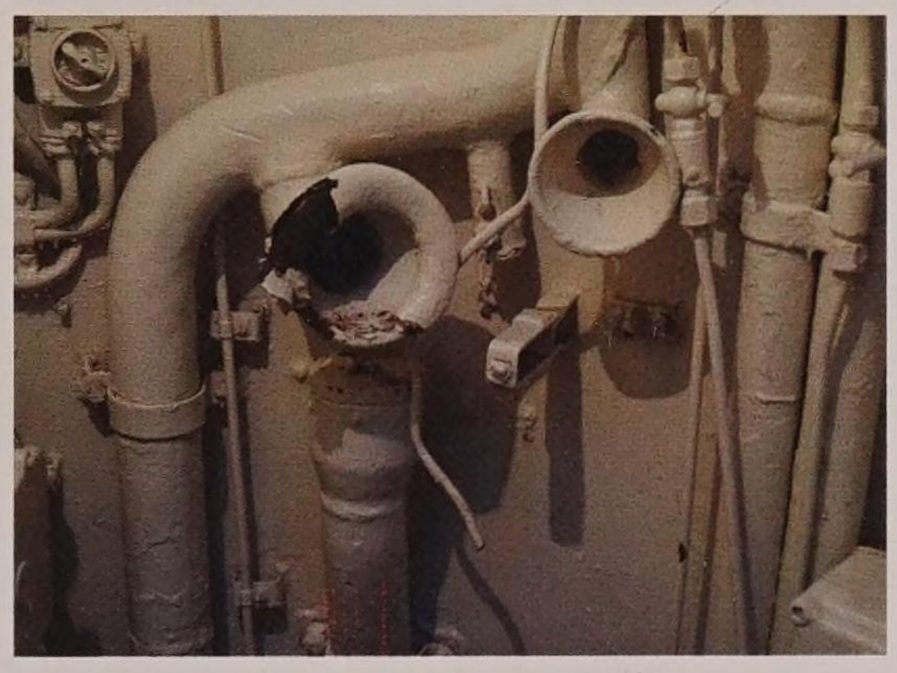
Beneath the floor were fresh water, waste water and fuel oil tanks, along with a battery room.

Room 4: To reach the **control room** – '*Das schlagende Herz*' or 'the beating heart' of the submarine – crew passed through a circular metal bulkhead door measuring 78cm in diameter. After working in a U-boat for any length of time, crew quickly learned to pass through the door feet-first, placing both hands on an overhead metal 'grab grip' over the entrance to swing their legs through. The grab often had a piece of old rag or a towel wound around for the benefit of newer crew members who usually banged their heads on the metal ring surrounding the inside of the door as they attempted to swing through.

Once inside the control room – an area directly beneath the conning tower – crew were confronted with a confusion of pipes, valves, electrical wiring, switches, dials, wheels, levers, pressure gauges, depth gauges, junction boxes, navigational instruments and a periscope. It was from here that the submarine was navigated, steered and controlled. A metal ladder with eight rungs, no handrail and fitted at an angle greater than 90°, led vertically up into the inside of the conning tower. From there another ladder with seven rungs led to the hatch leading to the bridge. The distance from the floor of the

BELOW The commander's seat from which he operated the attack periscope.

BELOW RIGHT Voice tubes used by the commander in the conning tower to speak to crew in the control room directly beneath, and men in the forward and aft torpedo rooms.

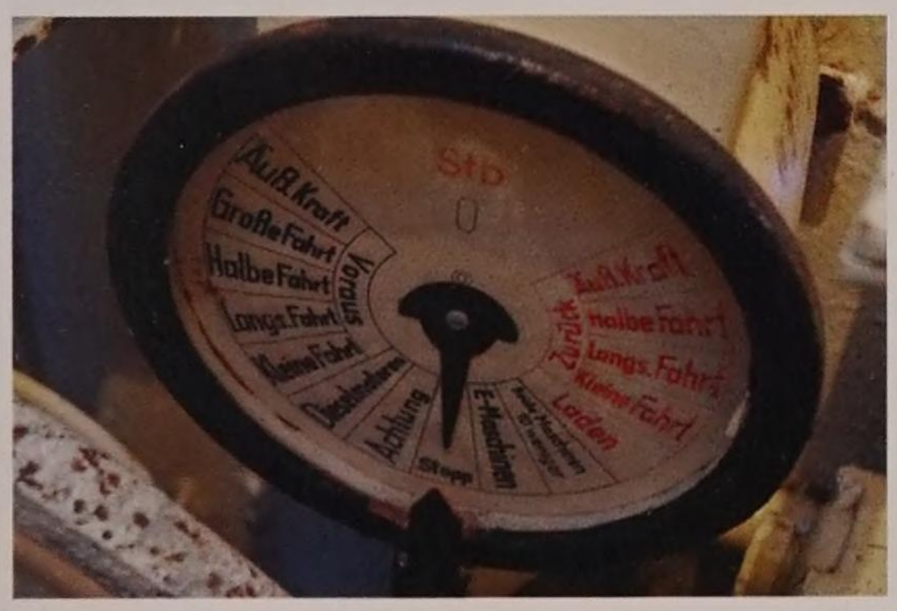


FAR LEFT Metal ladder leading to the conning tower and onwards up to the bridge.

LEFT Housing for the attack periscope inside the conning tower.

BELOW The floor inside the conning tower and surrounding the attack periscope contained dozens of small holes to drain away seawater which entered the compartment when the hatch above was left open.

BELOW While on the surface the Type VII could be controlled from the bridge on top of the conning tower. This is the engine telegraph positioned below the deck and inside the conning tower.



RIGHT The hatchway leading from inside the conning tower to the bridge.

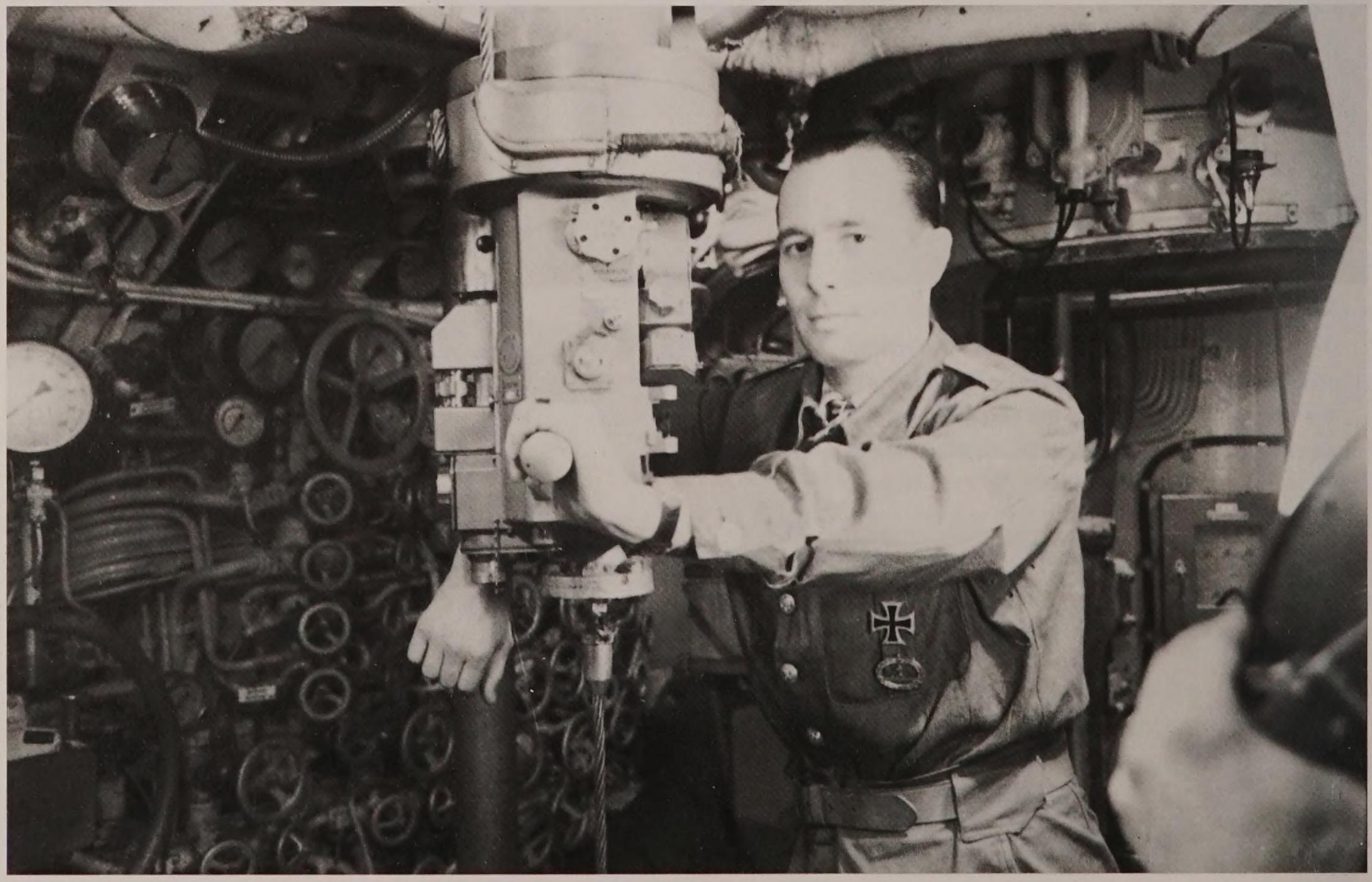
CENTRE Down the hatch! A crew member from U-390 takes a few deep breaths of fresh air through the conning tower hatch before returning to the stuffy atmosphere of the control room below. *(Through Their Eyes)*

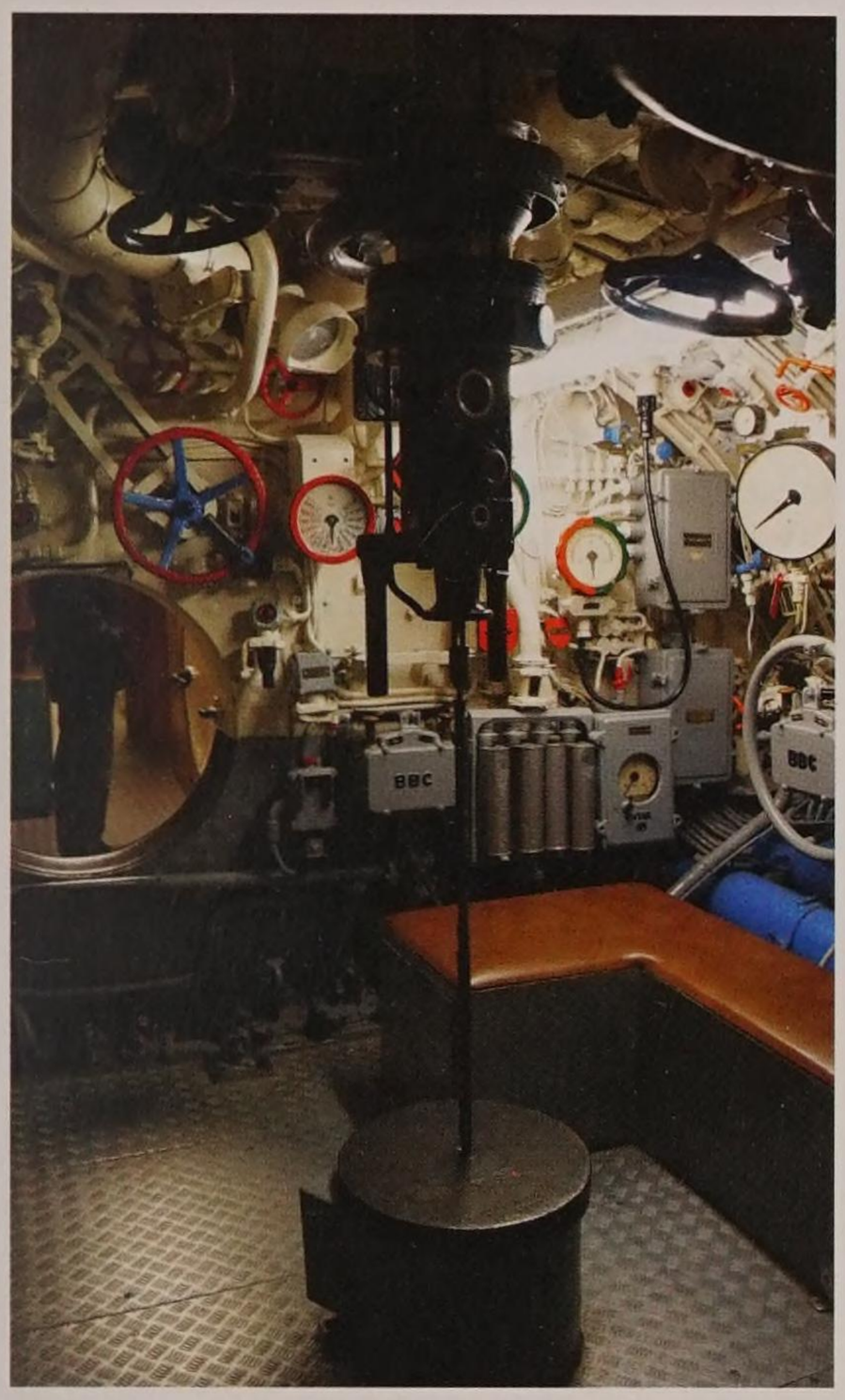
BELOW *Kapitänleutnant* Herbert Kuppisch preparing to look through the observation periscope of Type VIIC, U-94. *(Bundesarchiv)*

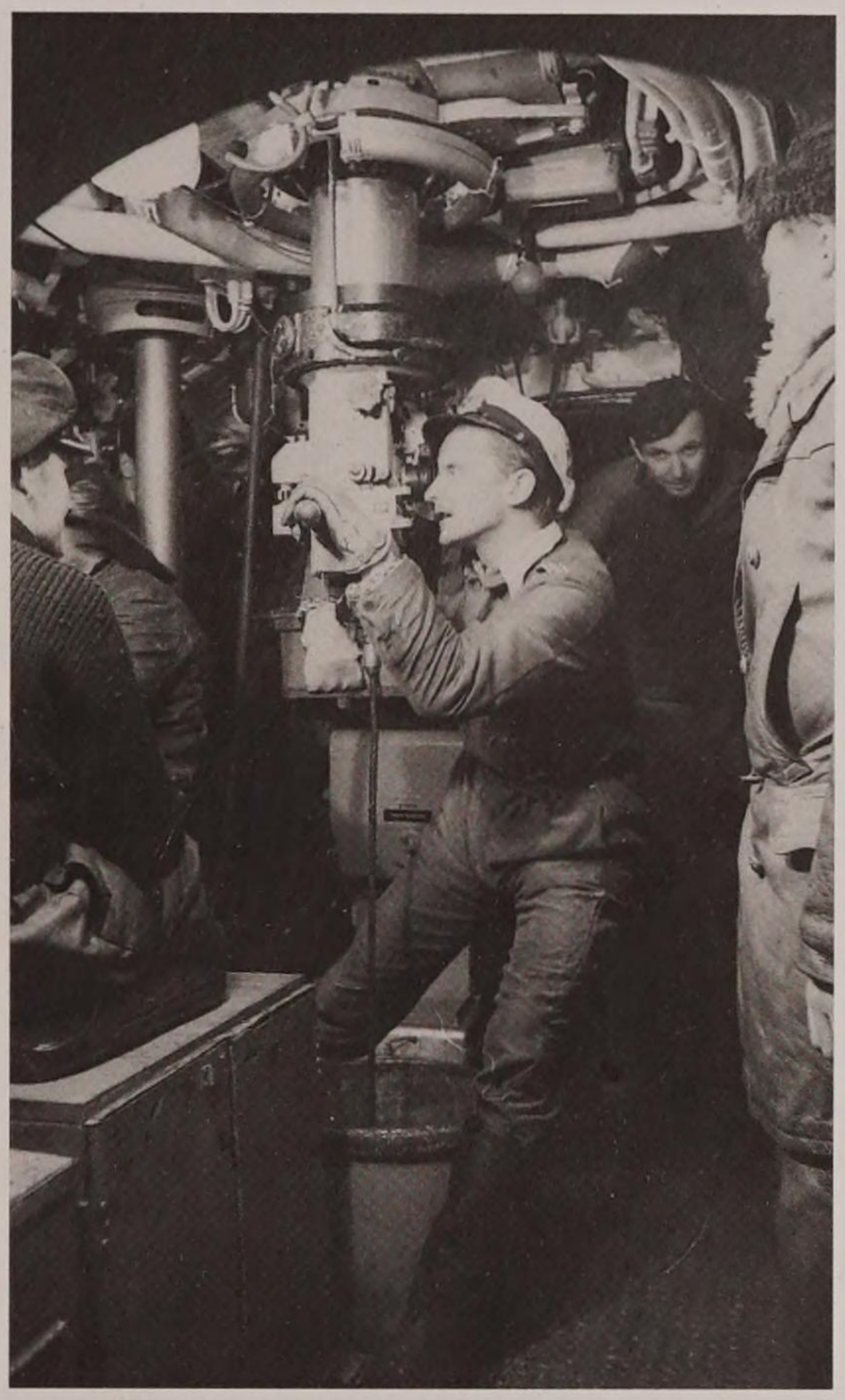
control room to the conning tower hatch was around 4.5m.

The centre of the room was dominated by a well shaft for a search periscope made from long steel tubing which extended up about 5m from the housing. The periscope was fitted with prisms and lenses at both ends which were controlled by a switch allowing the commander to toggle the magnification level to either ×1 or up to ×6.

Along the starboard side of the control room were positions for two hydroplane controllers responsible for the vertical movement of the boat. The navigator's chart table was positioned behind them. The aft end of the starboard side of the control room was taken up by an auxiliary bilge pump, while the port side was given over to machinery, including banks of valve handles controlling the flooding or venting of the boat's ballast tanks and the main bilge pump. This area was affectionately known as '*Der Weihnachtsbaum*' or 'the Christmas tree' thanks to brightly painted wheels, dials and levers reminiscent of the colours of Christmas. Valve handles were painted red or green to indicate the location of the tank they controlled.

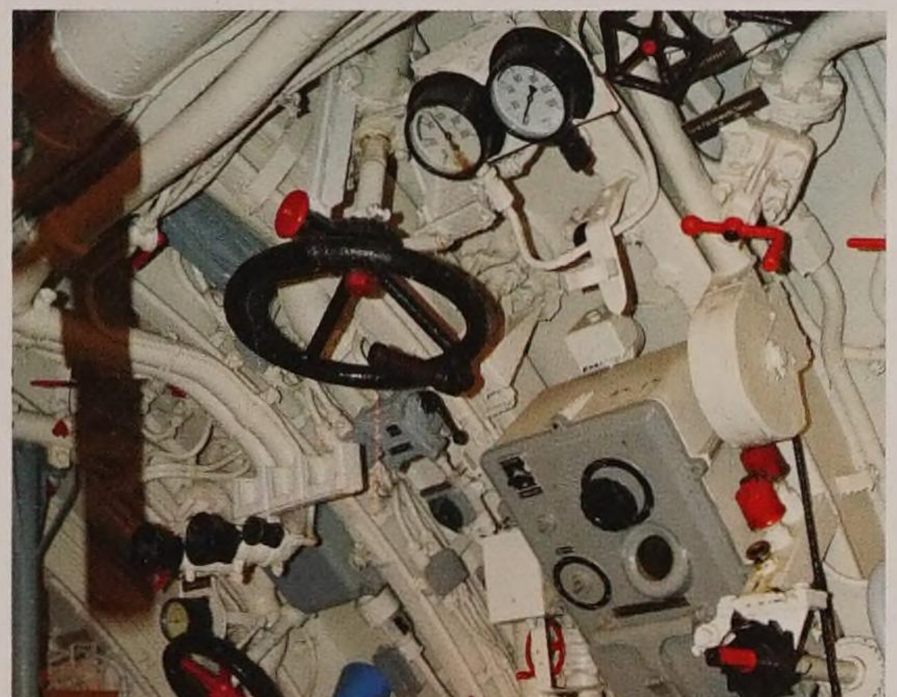




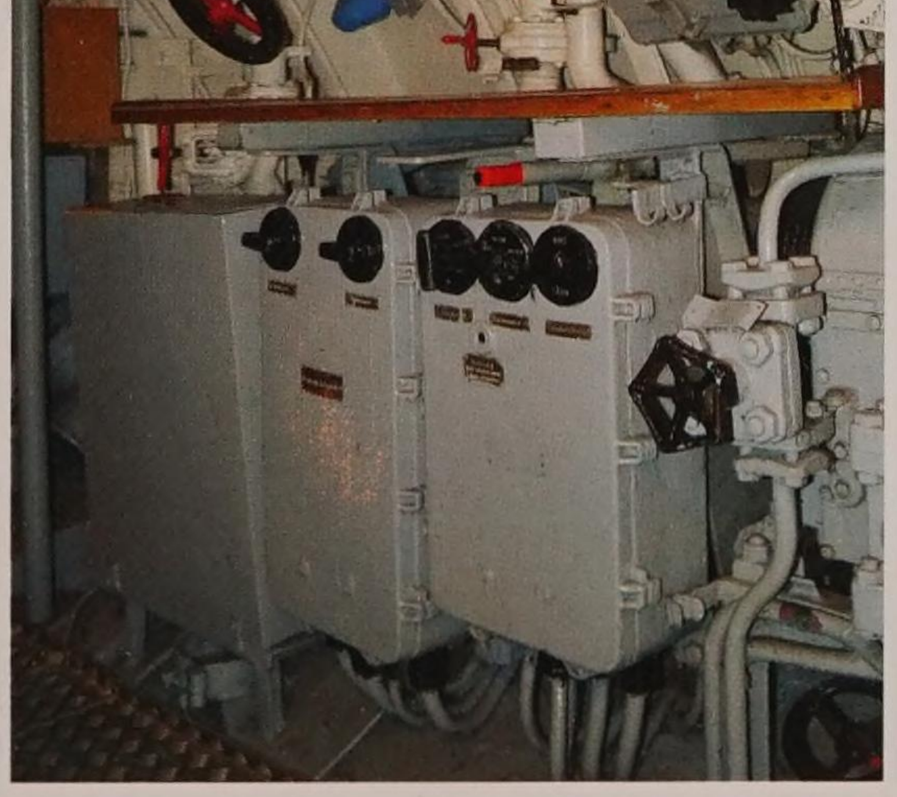


FAR LEFT Forward section of the control room. Note the round pressure hatch (leading to CO's room), periscope, helmsman and planesman position.

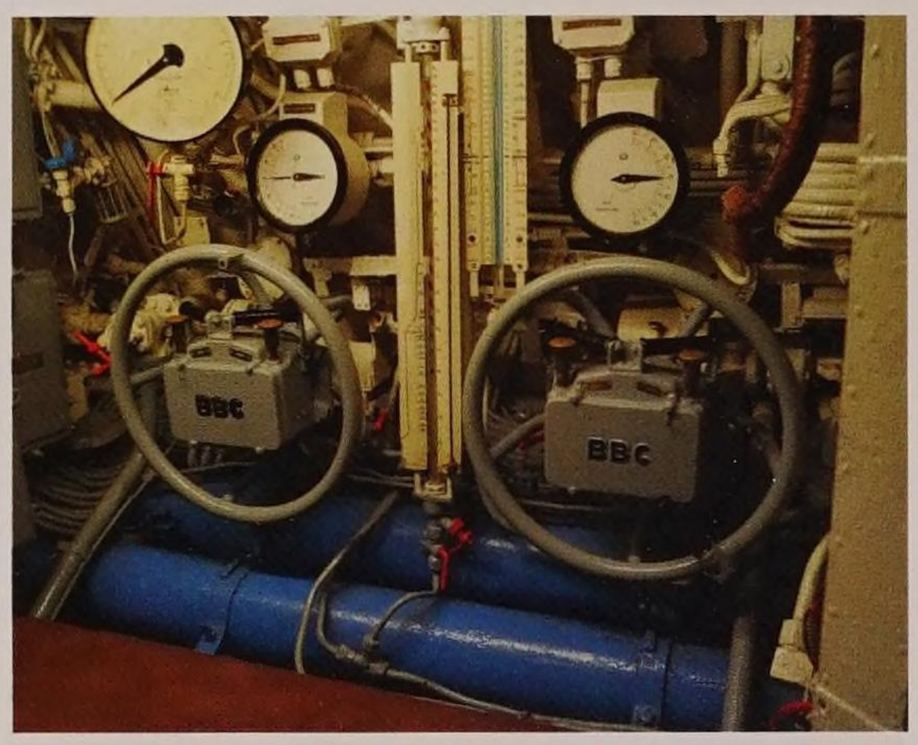
LEFT A U-boat commander tracking a British convoy and overhead aircraft through the observation periscope prior to making an attack. *(Bundesarchiv)*



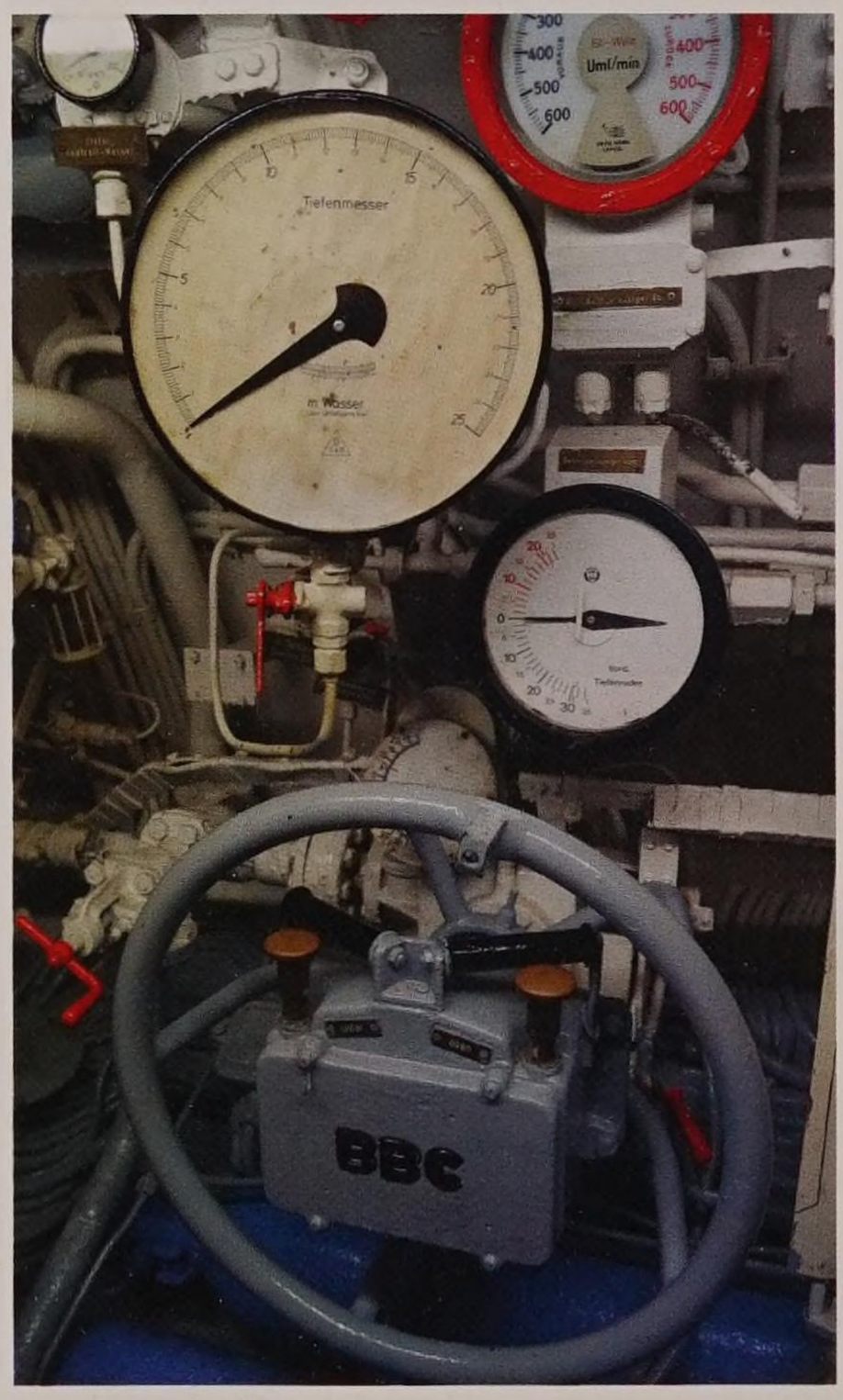
FAR LEFT The main blowing panel (or the 'Christmas tree') with valves to control the flooding and venting of the main ballast tanks.



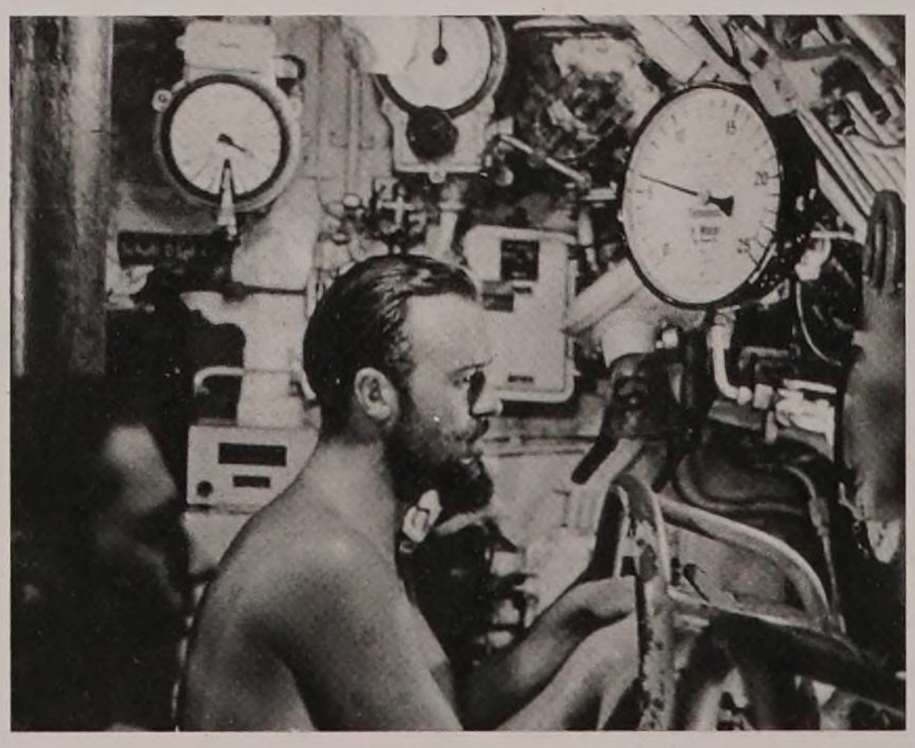
LEFT A view of the navigation table and above it a depth finder, valve wheels (for flooding the negative buoyancy tanks which give the boat weight and allow it to dive), a gyrocompass and a helm indicator. To the left of the chart table was a clock (now removed) always set to German Central Time.



RIGHT Planesman controls on the starboard side. The two large steering wheels operate the fore and aft hydroplane controls. Behind each wheel is the mechanical hydroplane angle indicator. Above each wheel is a hydroplane angle indicator gauge. The device in the centre which looks like a thermometer is an inclinometer (or tilt sensor) and a depth gauge indicator used when the boat is at periscope depth. The top left gauge above the left wheel is the shallow depth gauge, recording depths up to 25m.



RIGHT The planesman operated the hydroplanes by pressing two buttons on the hydroplane wheel. Physical turning of the wheel only took place if the mechanical controls broke down or were taken out of service. A set of hand-wheels were also used to help control the boat's buoyancy.



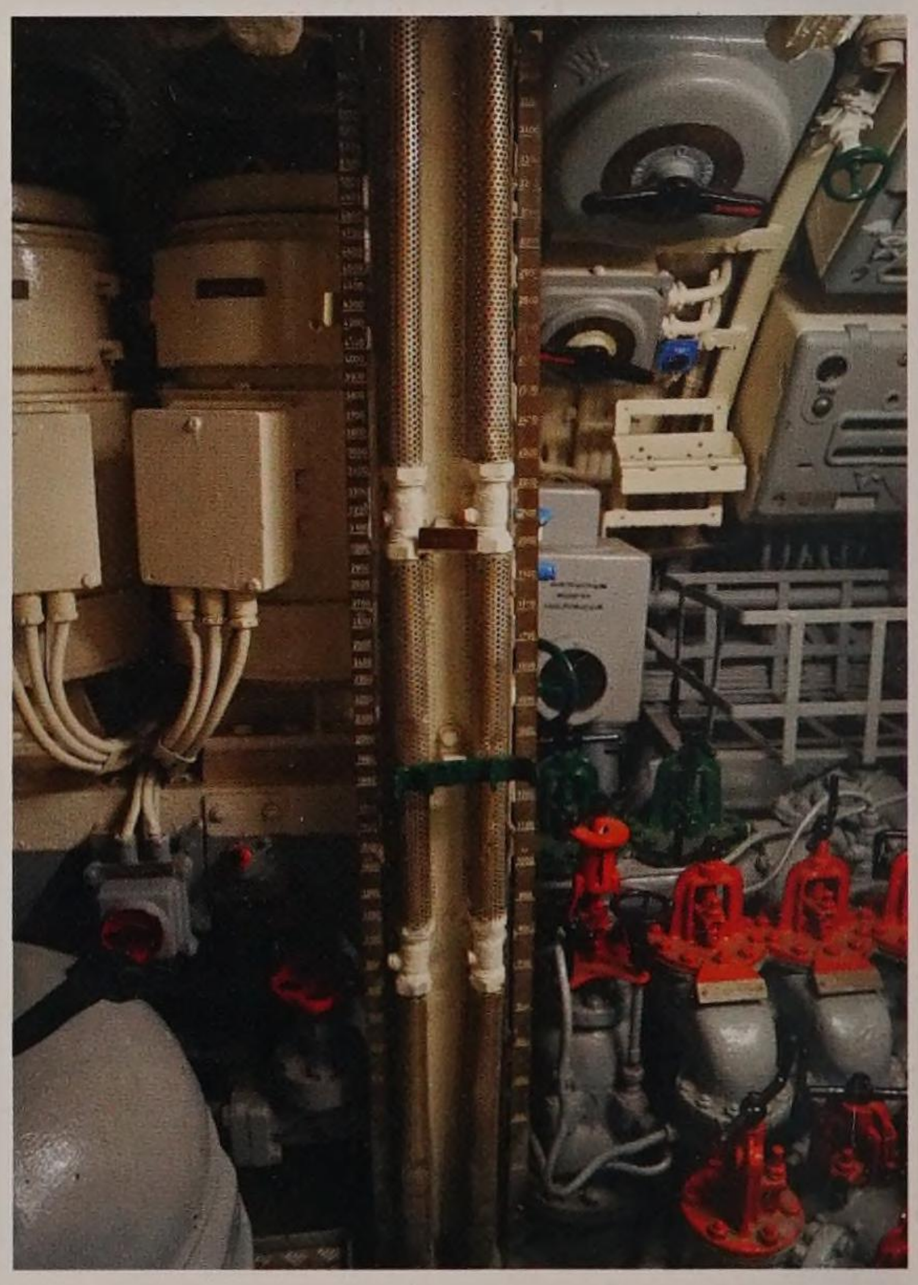
RIGHT The planesman at work in the control room. *(Karl Parlour)*

A downward-curved horizontal bulkhead separated the control room from the circular hull section. This space was given over to the large internal tanks characteristic of the Type VII. The tank space was further divided into three sections by two vertical partitions. Forward and aft was where the main fuel oil bunkers were positioned, while the main ballast tank was located in the centre.

The control room also operated the helm, fitted to the forward bulkhead. The rudder was controlled by two push buttons which

ABOVE A keen eye was always kept on the engine room telegraph, although in this posed picture the gauges are showing a negative position.

BELOW Depth indicator.



sent electric signals to the steering gear. To the right of the helm was the gyrocompass and controls for the fore and aft hydroplanes which controlled the depth of the boat while submerged. Valves to the right of the hydroplane controls controlled the U-boat during submerging and surfacing.

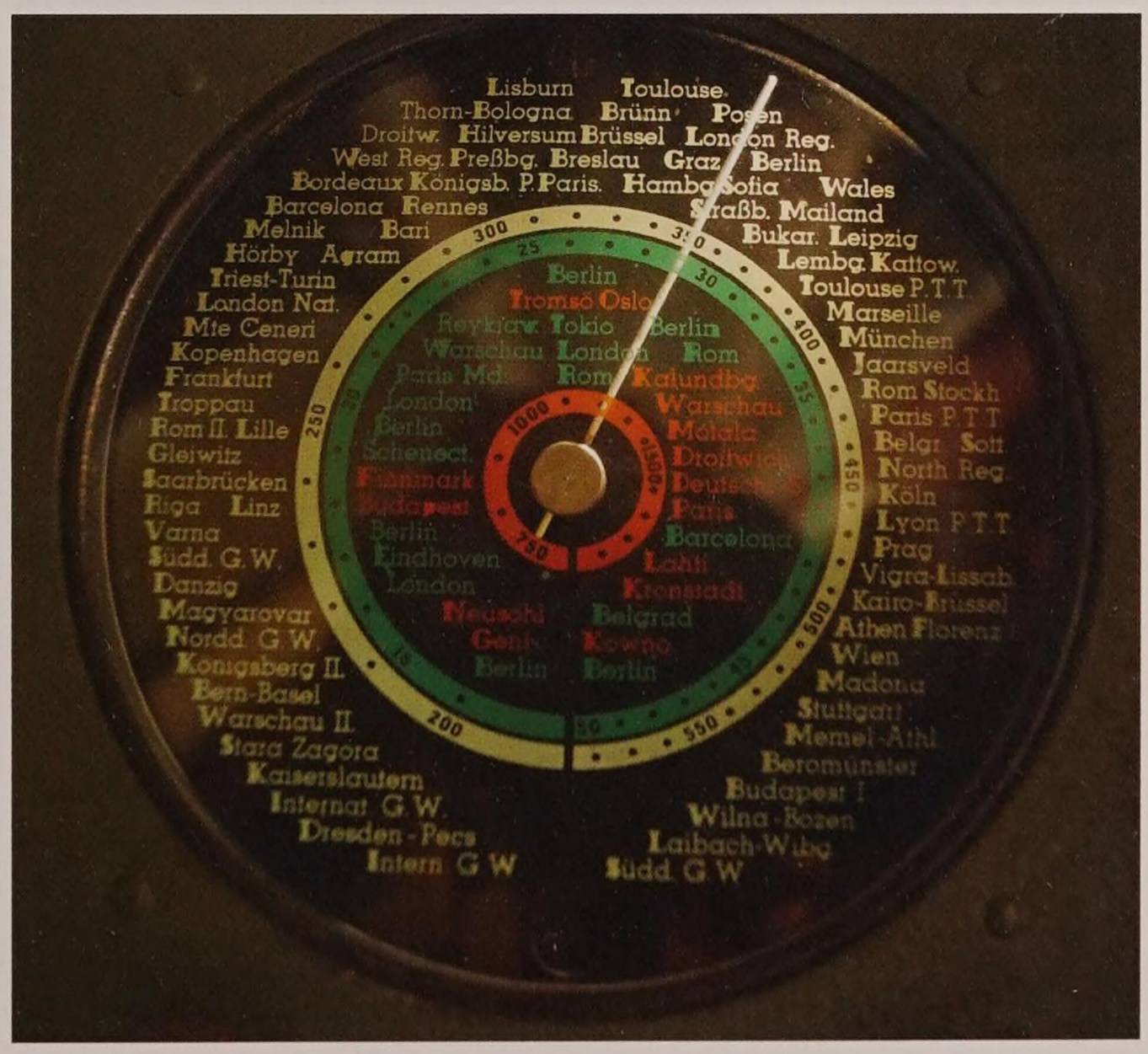
Room 5: Passing through a second round bulkhead door brought crew members to the outside of a green curtained-off area marking the **commanding officer's private 'cabin'** – a small area containing his bed, a folding table and a small wooden cupboard with a short-wave radio on top. The 'cabin' also acted as the commander's office and he could decide whether or not he wanted the curtains open or closed. Closed curtains sent out the signal 'do not disturb'.

Two small rooms were located next door to the commanding officer's cabin – the **radio communications room** and the **listening room**. Each room had a door fitted with a glass window allowing anyone passing to see who was on duty – and to make sure they had not fallen asleep on the job.

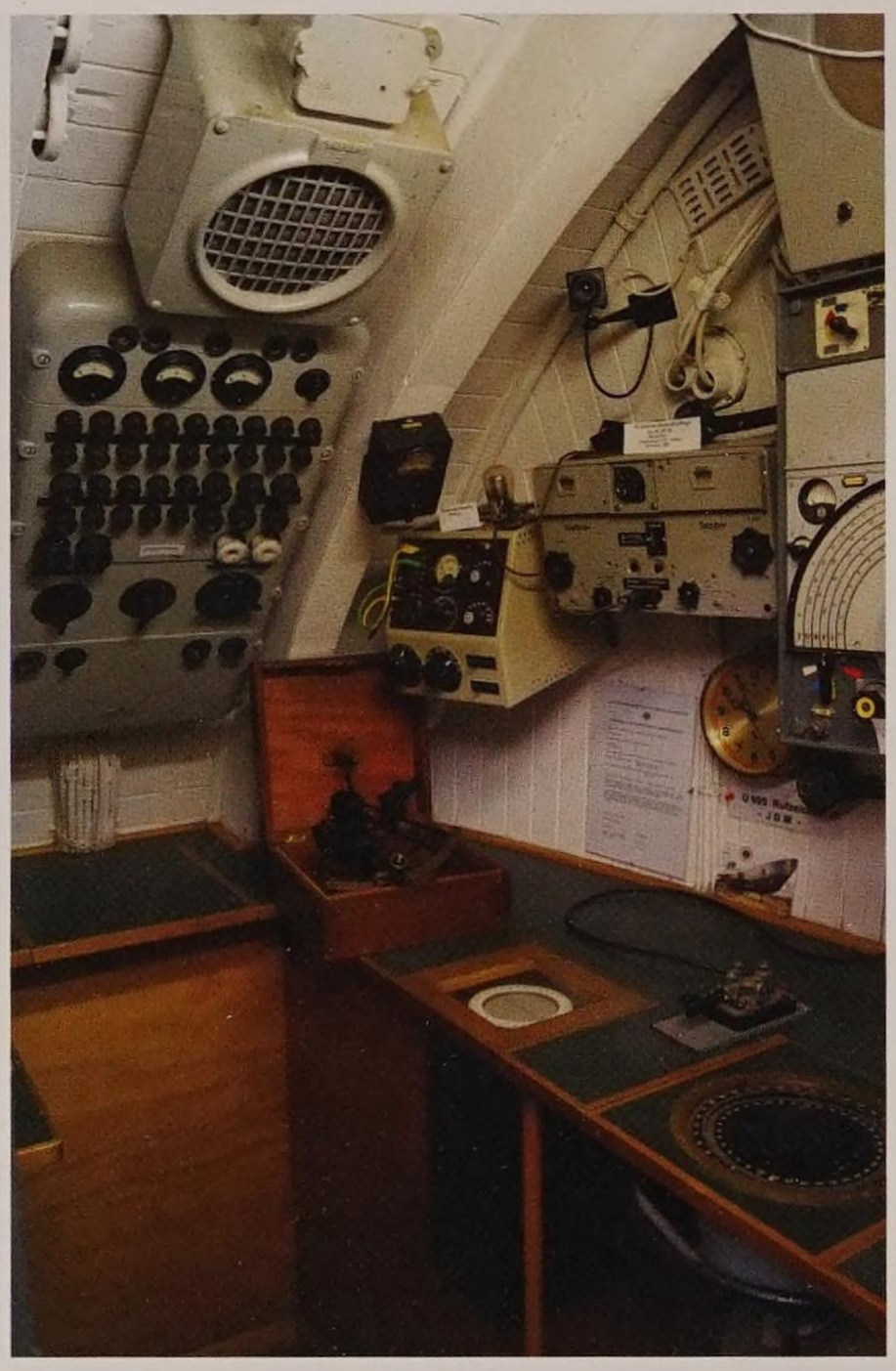
The **radio communications room** allowed the boat to keep in touch with U-boat command headquarters. Because U-boats usually operated in groups using *Rudeltaktik* – 'wolfpack tactics' – they attacked convoys coordinated by Dönitz and his staff. At headquarters, staff collected and analysed intelligence about Allied shipping before directing U-boats towards specific target convoys. Although only large enough for one man, the radio communications room was the 'office' of three men, known as the '*funkers*' (telegraphists) – the *Oberfunkmeister* (senior radio officer), *Funkmaat* (radio petty officer) and *Funkgast* (radio operator). Their job was to listen to the sounds of the world around them – both near and far – using banks of hydrophonic and electronic equipment, to send and receive all radio traffic, to undertake decoding and encoding of radio messages, use hydrophone devices, detect enemy radar and utilise the submarine's own radar devices.

When the submarine was submerged, '*funkers*' could still receive long sound waves at a depth of some 60–70ft and radio signals when the aerial was 30ft under water. Short

ABOVE AND BELOW **The commander's spartan cabin was located forward of the control room and opposite the radio and receiving rooms. The cabin was located amidships to provide the crew fast access to the commander in the event of a surprise attack or an emergency. A green screening curtain provided the only privacy in the entire submarine. Along with the boat's chief petty officers, he slept on a bunk with a leather-lined mattress instead of the cotton lining which covered the remainder of the crew's mattresses. Apart from having a larger cupboard and a shelf for his belongings and private papers, the only other 'luxuries' were a table and a powerful broadcast radio receiver that could be hooked up to the boat's own sound system to share radio news and musical programmes with the rest of the crew.**



RIGHT The radio communications room allowed submariners to keep in touch with U-boat command headquarters. Although only large enough for one man, the radio communications room was an 'office' for three men, known as the '*funkers*' (telegraphists) – the *Oberfunkmeister* (senior radio officer) *Funkmaat* (radio petty officer) and *Funkgast* (radio operator).



ABOVE Radio installations consisted of short and long wave equipment plus an auxiliary direction-finding receiver. The direction finder was used to obtain relative bearings from radio beacons and to set its own location. It consisted of a direction-finding receiver and pressure-resistant and watertight loop antenna. Thanks to their excellent direction and receiving properties, the longest waves were suitable for receiving signals while the U-boat was submerged.

and medium sound waves, however, could not penetrate the sea.

Radio installations consisted of short and long wave equipment plus an auxiliary direction-finding receiver. The short wave consisted of a transmitter (output power 200W, frequency range 3,750–150,000kHz and wavelength 80–20m) and a six-stage receiver (1,500–2,500kHz, wavelength 200–12m). The transmitter consisted of three-stages, with a continuously variable frequency. The control stage was divided into ten separate ranges, which overlapped, and the transmitter could be switched into a toneless or sounding telegraphy mode.

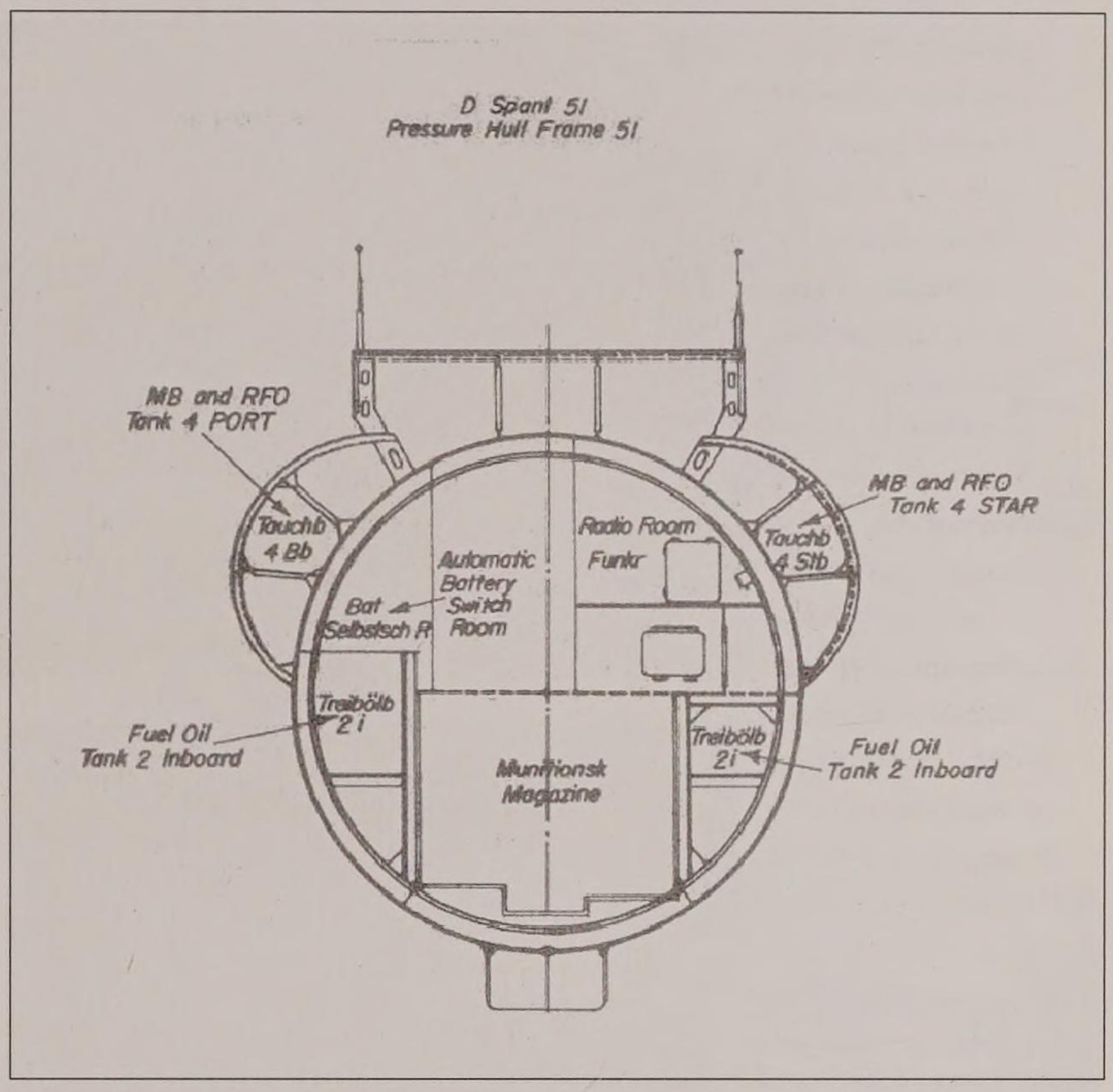
BELOW **The *Funker* at work in the radio room of U-124 with his codebooks.** *(Bundesarchiv)*

The receiver was a five-tube, six-stage large ship receiver with the frequency range divided into eight separate overlapping ranges. Long-range equipment consisted of a transmitter (output power 150W, frequency range 300–600kHz, wavelength 1,000–500m) and a direction-finding long wave receiver. Unlike the short wave transmitter, the output stage with antenna circuit was separate from the main transmitter casing. The following voltages were needed for operation:

- 1,500V DC for powering vacuum tube anodes in output stage.
- 400V DC for powering vacuum tubes in output stage, by which output power control was possible.
- 280V AC for heating cathodes of tubes in all stages and after previous transformation and rectification as a cut-off and biasing voltage in control and output stages.

Both transmitters could be connected with common control units by means of a selector

RIGHT Pressure hull cross-section, Frame 51, showing radio room, magazine, battery switch room, main ballast and fuel oil tanks. *(U-boat Archive)*



switch on the transmitter switchboard. The unit provided a telegraph key, output power control, volume control and operation control (toneless telegraphy) selection.

The direction-finding installation was used to obtain relative bearings from radio beacons and to set its own location. It consisted of a direction-finding receiver and pressure-resistant and watertight loop antenna. The direction-finding receiver had two operational ranges:

- frequency – 1,000–75kHz, wavelength – 300–4,000m.
- frequency– 25–15kHz, wavelength 12,000–20,000m.

Thanks to their excellent direction and receiving properties, the longest waves (12,000–20,000m) were especially suitable for receiving while submerged.

The next-door **sonar listening (or hydrophonic) room** was equipped with a hydrophonic indicator which acted like a primitive SONAR device, enabling the boat to detect and identify other ships while submerged. This was also essential for rapid escape when being hunted and depth charged

FAR LEFT AND LEFT The sonar listening (or hydrophonic) room was equipped with an array of receivers and radios, including a hydrophonic indicator which acted like a SONAR device, enabling the boat to detect and identify ships while submerged. The hydrophonic indicator could pick up lone vessels up to 20km away and convoys up to 100km distant, depending on sea conditions.

ABOVE A 1944 photograph of a U-boat portable radar search receiver for S-Band and X-Band signals mounted on the bridge.

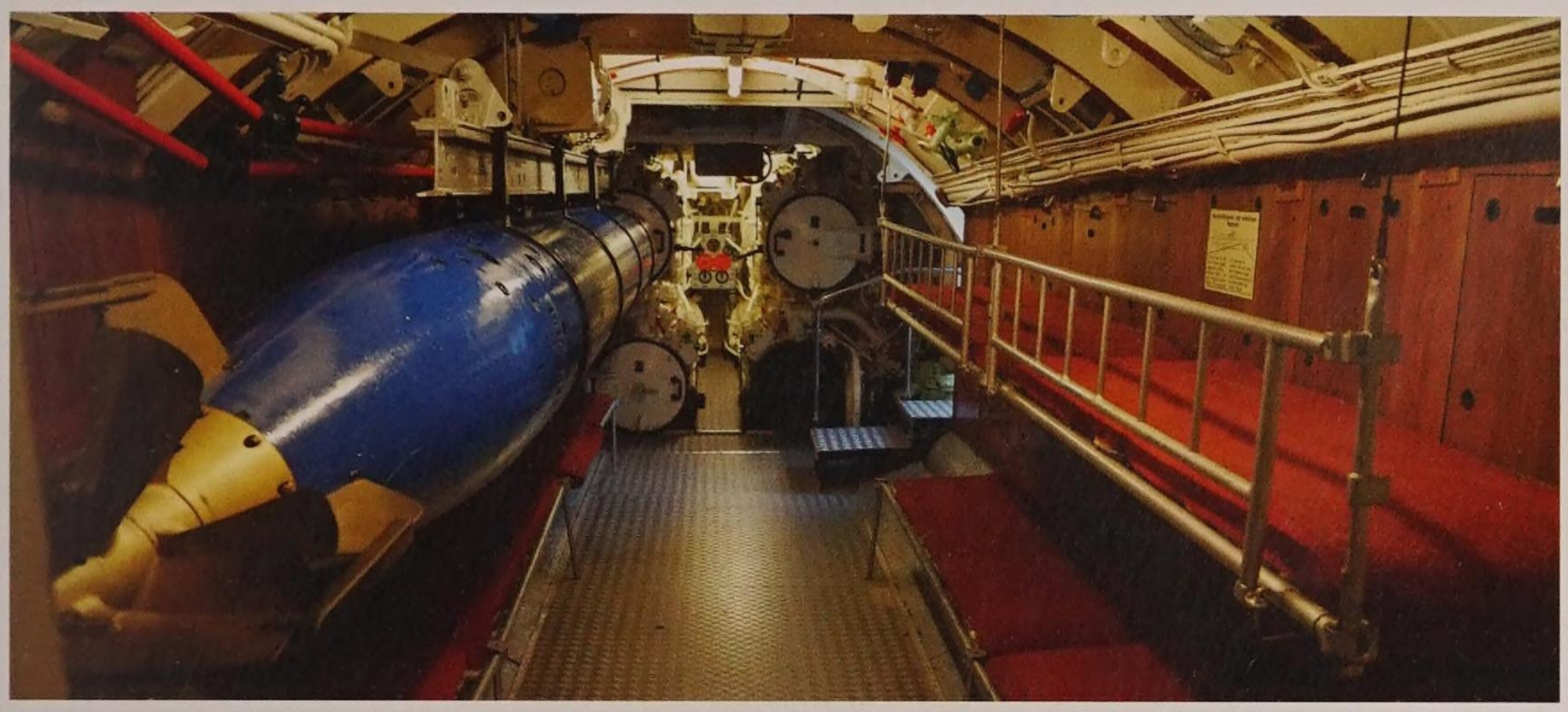
ABOVE RIGHT The submarine's chief petty officers (navigator, bosun, diesel officer and motor officer) each had their own bunk. They also had a small folding mess table of their own and slightly larger cupboards than the rest of the crew.

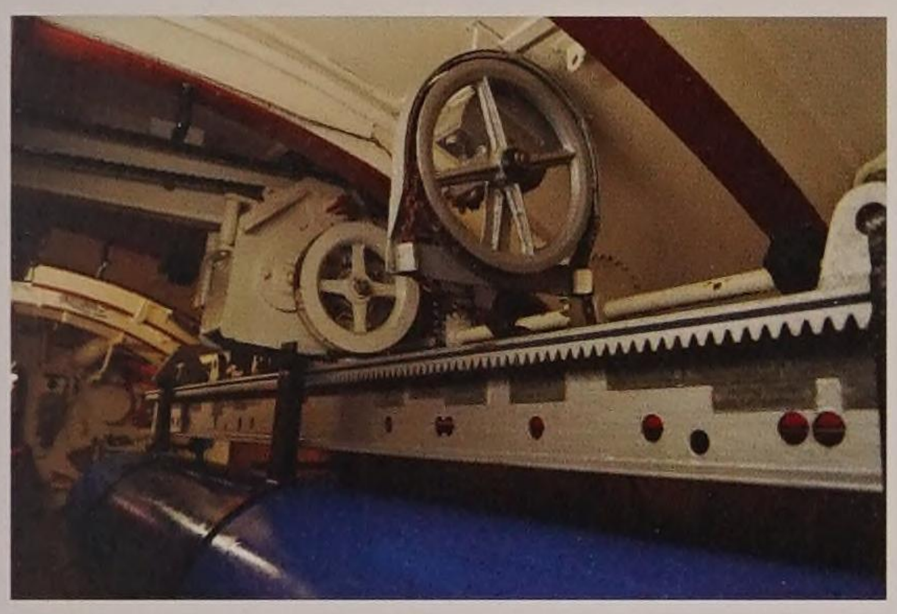
by Allied escort vessels. Hydrophones consisted of two pairs of underwater microphones which listened to the sounds of ships' propellers. By measuring the amount of time it took for sound to arrive at each of the microphones, the device could triangulate the bearing of the vessel. The radio operator could also tell if it was a merchantman or a warship, but not the range, direction or speed at which it was travelling. Because sound travels further underwater, hydrophones could monitor distant convoys travelling up to 100km away. For maximum effectiveness, however, the U-boat had to submerge and stop all engines while the hydrophones listened in. It also had the added bonus of being passive.

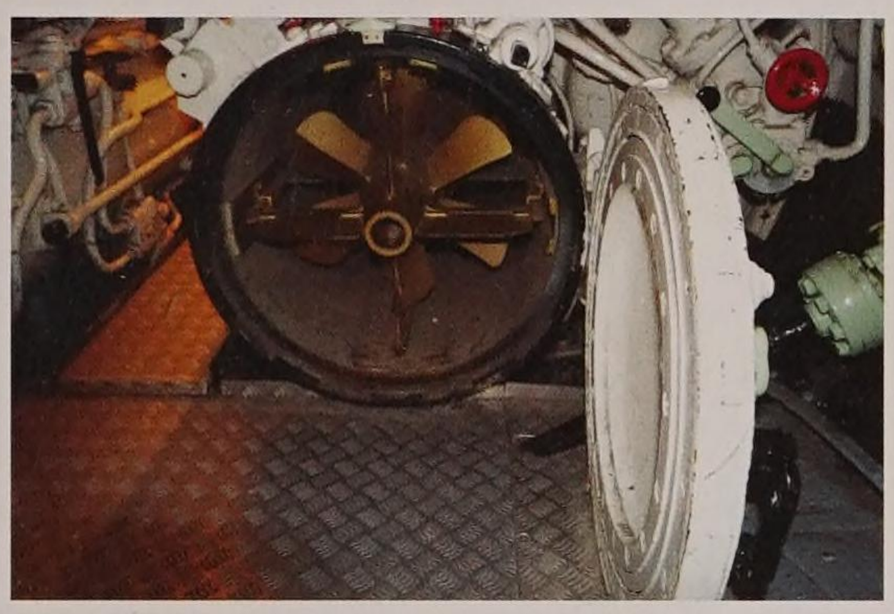
The standard U-boat hydrophone – the GHG (*Gruppenhorchgerät* or Group Listening Apparatus) – was installed in U-boats from 1935 onwards. It consisted of 11 (and later upgraded to 24) circular sound-receiving diaphragms on each side, arranged around the forward dive planes in a semicircular pattern. Because hydrophones could not be rotated, the arrangement was most effective with sound sources coming from the sides, with deteriorating accuracy as the source moved towards the front or rear of the boat. The GHG could pick up lone vessels up to 20km away and convoys up to 100km distant. The detection range, however, was also dependent on sea conditions.

There was also a fully working **WC** in this section, fitted with a blue light above the door that had to be turned on once the small room became occupied and turned off when vacated. For more information about the strict rules and regulations of operating the flushing system for the WC see pages 132–133, Much ado about flushing.

Space was also provided in this section for three officers – the first and second watch officers and the chief engineer – each of whom had the privilege of sleeping in their own bunks. Each bunk in the Type VII U-boat measured the same – 1.8m long and 0.60m wide. Modern-day single beds are usually the same length, but the width of a Type VII bunk was a third less than modern versions, making it easy to fall out of, especially in rough seas. There was also a **warrant officers' mess** with eight bunks and







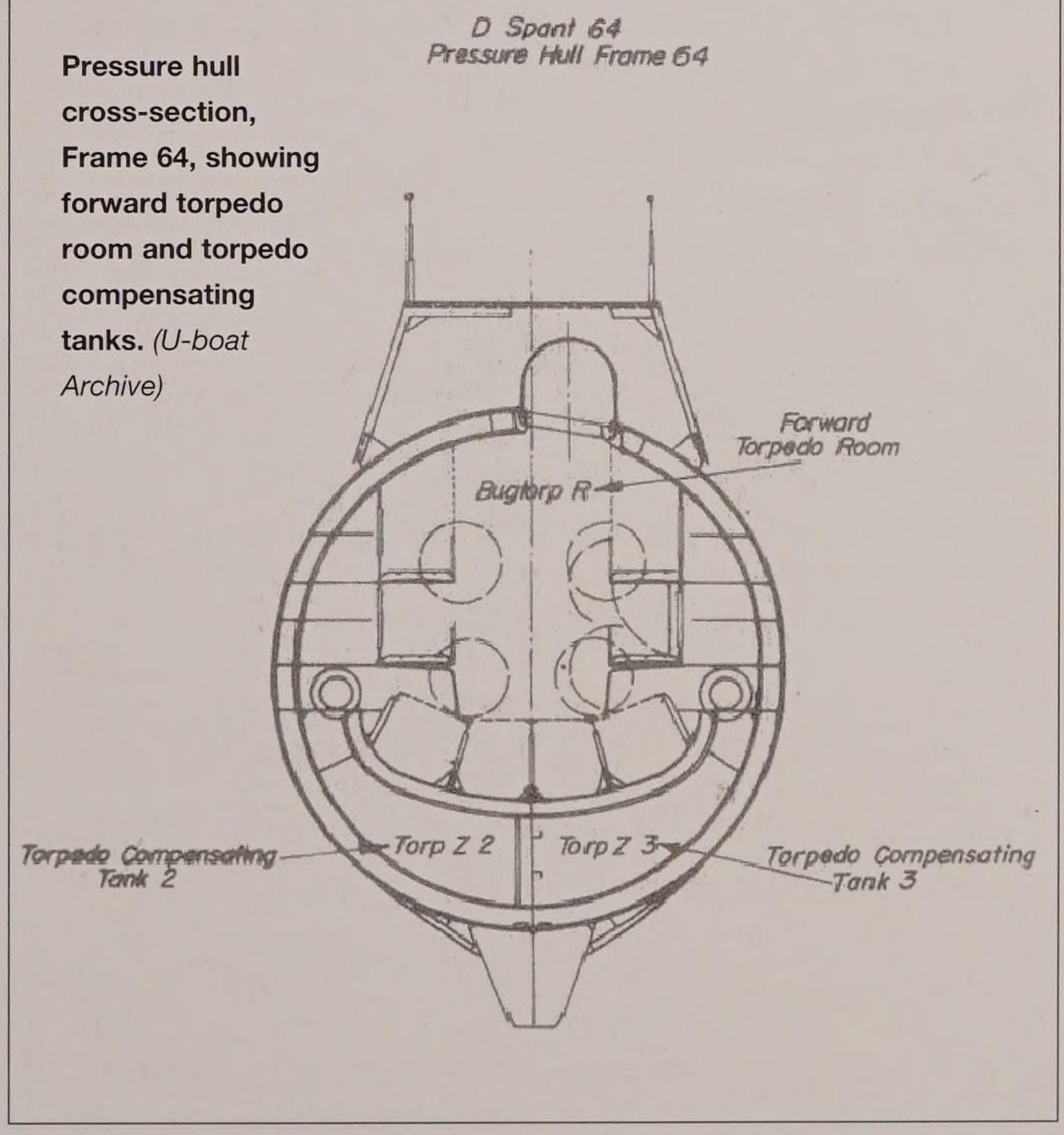
LEFT The forward torpedo room also served as living quarters for up to 27 enlisted men who lived, slept, ate and worked here. Four torpedo tubes that formed the submarine's main armament were stored here. The torpedoes used were the standard G7e weapon measuring 53.3cm in diameter, 7.15m in length and carrying a deadly warhead of 280kg. Besides the five torpedoes in the fore and aft tubes, the Type VIIC U-boat could store up to seven spares.

fitted with small wooden cupboards just big enough for a few personal effects.

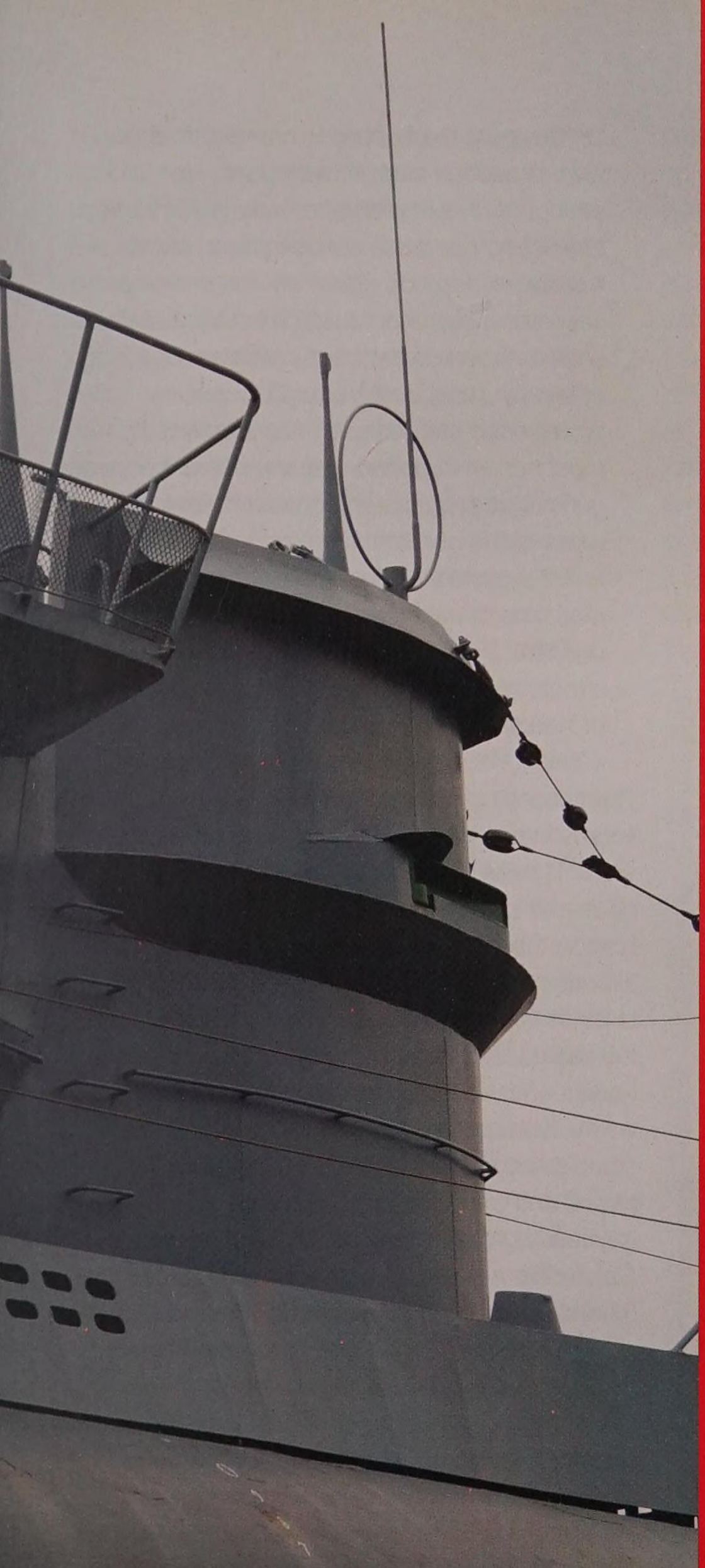
Beneath the floor was a fuel oil tank, storage for explosive charges, a munitions magazine, an active sonar room, wash water tank, waste water tank and the battery room.

Room 6: Moving on through the vessel, the crew now arrived at the **forward torpedo room**, which also served as living quarters for up to 27 enlisted men who lived, slept, ate and worked here. At the start of a patrol, the already-limited crew space was further confined, owing to the amount of food stored everywhere in the boat and victuals hanging from the deckhead.

Four torpedo tubes that formed the submarine's main armament were stored here. Torpedoes used were the standard G7e torpedo measuring 53.3cm in diameter, 7.15m in length and carrying a deadly warhead of 280kg. They were propelled by an electric motor with a maximum speed of 30 knots and a maximum range of 4nm. Besides the five torpedoes in the fore and aft tubes, the Type VIIC U-boat could store up to seven spare torpedoes.



Pressure hull cross-section, Frame 64, showing forward torpedo room and torpedo compensating tanks. *(U-boat Archive)*



Chapter Four

Type VII armament

The *raison d'être* of the Type VII U-boat was to sink enemy shipping. U-boats carried a variety of weapons for this task of which the torpedo was their primary tool for the job. As the war progressed life for U-boat crews became increasingly dangerous and they needed to defend themselves from attack by aircraft and convoy escorts. Defensive weapons proliferated including flak defence suites and deck guns along with the installation of 'Bandstands' and 'Wintergardens' to accommodate an ever changing rotation of different weaponry.

OPPOSITE The 'Bandstand' and 'Wintergarden' on U-995, sporting a pair of twin 20mm AA guns and a 3.7cm cannon.

U-boats were vulnerable to any kind of enemy shellfire coming from aircraft or other surface vessels. A single piercing bullet in the pressure hull could disable a submarine, prevent it from diving and render it totally defenceless. A larger shell could send it to the bottom in minutes.

To repel air attacks, conning tower areas of Type VII class U-boats were redesigned, modified and rebuilt numerous times throughout the war to accommodate different **deck guns** and **'flak' guns** – (*flugabwehrkanone* or air defence cannon). Modifications were necessary, but met with limited success. In his personal war log, Dönitz wrote:

> *Of its nature the U-boat is intended to fight with torpedoes and not with guns. Her strength is in being able to make a surprise attack and her protection is in deep diving. A full-scale torpedo attack always promises success; a gun action, which is always full-scale as soon as the boat is within range of enemy guns, does not by any means promise the same results. Nevertheless it must not be forgotten that she needs her guns to stop a ship and break resistance when she is not from the first in a position to fire a torpedo at the enemy. It takes a long time to haul ahead and it is not always possible. To renounce the use of guns altogether would therefore lower the chances of success considerably.*

The concept of **'*U-flak*' or '*Flak Trap*'** submarines originated in September 1942, when Type VIIC boat U-256 was attacked and damaged in the Bay of Biscay by a Whitley bomber from No 77 Squadron of the RAF. The aircraft strafed and dropped several bombs, but U-256's flak hit the aircraft and it crashed into the sea. U-256 limped back to its home port of Lorient and, due to extensive attack damage, was withdrawn from service. But rather than scrap the boat, it was refitted as a heavily armed anti-aircraft boat to combat losses inflicted by Allied aircraft. Two 20mm quadruple *Flakvierling* mounts and an experimental 37mm automatic gun were installed on deck.

LEFT Increasing enemy air attacks on U-boats forced the Kriegsmarine to reconsider how the Type VII's flak defence suite could be improved along with the role of flak guns and their position on deck. This resulted in the conning tower area being redesigned and extended to provide improved facilities for attack and defence. The redesigned area was known as the '*Turmumbau*' (the German name given to the conning tower) – known as '*Turm*' for short. Submarine crews referred to conning tower extensions as the '*Musikkapellentribüne*' (bandstand) and '*Wintergarten*' (winter garden). The picture shows the starboard 20mm AA deck gun on its LM43U mount on U-995's bandstand.

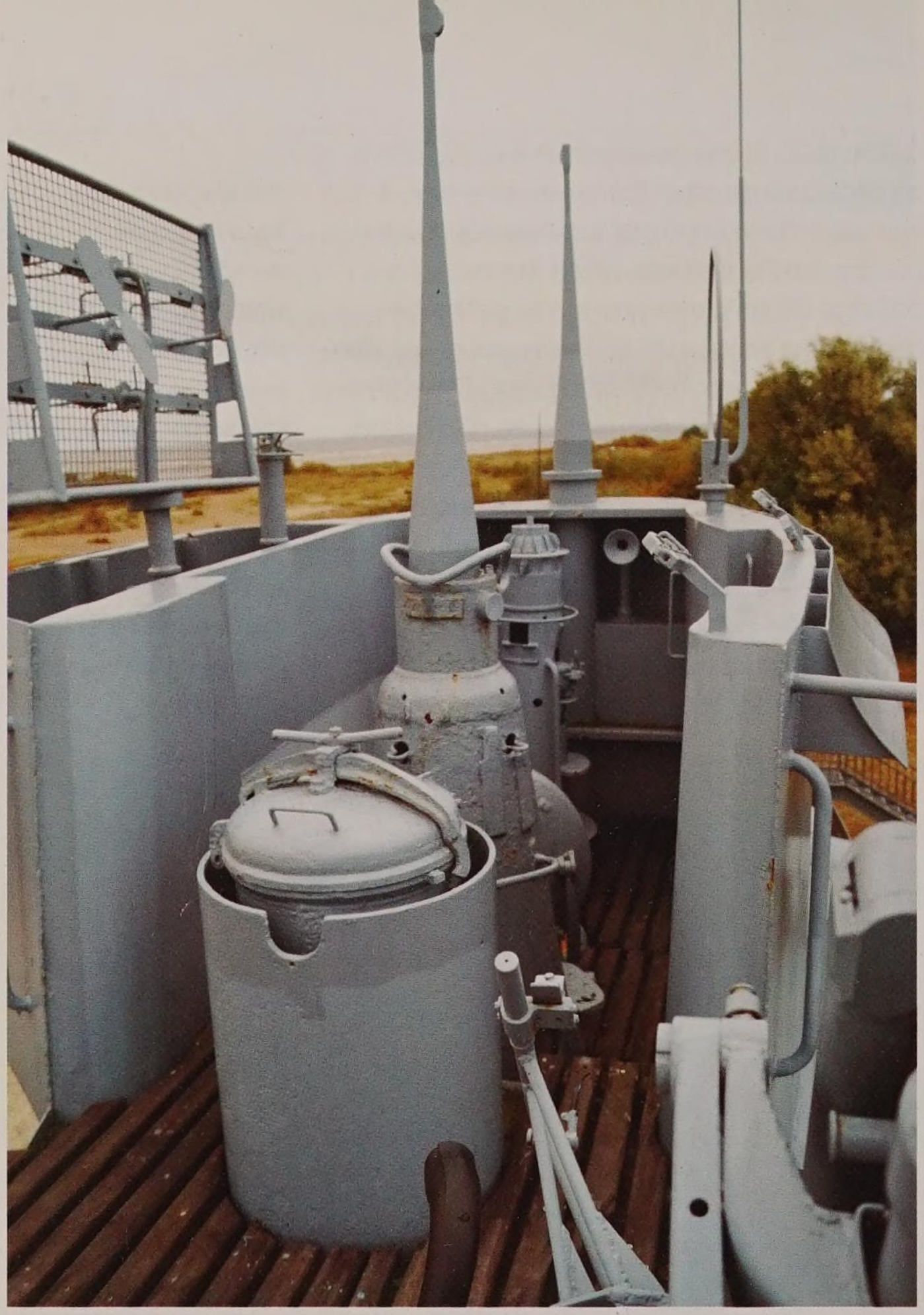
A battery of 86mm line-carrying anti-aircraft rockets was also tested (similar to a device used by British forces to defend airfields), but this idea proved unworkable on submarines. At times, two additional single 20mm guns were also mounted but the submarines' limited fuel capacities restricted them to operations only within the Bay of Biscay. Five torpedoes were carried, preloaded in their tubes to free up space for additional gun crews.

Type VIIC 'Flak boats' were designed as the ultimate defence solution to air attacks on submarines. However, to accommodate multiple anti-aircraft emplacements, bridge structures had to be enlarged and strengthened, adding to the submarine's top weight and causing stability problems, especially in rough seas. The enlarged bridge also added to the boats' hydrodynamic resistance, increasing diving time and reducing underwater speed. Additional crew on the bridge also meant that extra time was needed to clear the decks when crash-diving under attack. Anti-aircraft guns also took up a great deal of additional space, meaning that only five torpedoes could be transported, while reduced fuel bunkers meant that boats were unable to operate to distant areas.

The modified boats became operational in June 1943 and at first appeared to be successful against the RAF. Expecting that extra firepower might allow boats to survive relentless air attacks in the Bay of Biscay on route to operational areas, Dönitz ordered boats to cross the bay in groups running at maximum speed. The effort earned the Germans about two more months of limited freedom until the RAF modified its own tactics. When a pilot saw a U-boat preparing to fight on the surface, he held off an attack, radioed for re-inforcement aircraft and continued circling the U-boat out of range of its guns but remaining sufficiently close to bomb the submarine when it attempted to dive. If the boat succeeded in diving, surface vessels were called in to scour the area with sonar and drop depth charges. The RAF also equipped aircraft with rockets that could sink a U-boat with a single hit, finally making it too dangerous for submarines to attempt to fight it out on the surface, regardless of its armament.

Modified Type VIIAs and early VIIB models carried a single clip-fed, rapid-firing medium-calibre C/30 20mm naval gun in a C/30 version on deck casings aft of the tower. However, it was soon discovered that this was not an ideal position for the weapon, which obstructed the passage of gun crews hurrying to get below deck during aerial attacks. The weapon was also found to be insufficiently waterproof. The breech and barrel assembly also had to be dismantled and stored in a watertight ammunition locker in the deck casing before the boat crash-dived and remounted again once it resurfaced. Not only did this hinder the boat from rapidly diving, it also placed gun crews in danger while they desperately packed the weapon away, making them targets for enemy aircraft.

BELOW On board Type VIIB U-86 showing *Oberleutnant* Walter Schug with officers and a senior helmsman and their 88mm flak gun. U-86 sank three merchant ships with a total tonnage of 9,614grt and badly damaged a fourth ship of 8,627grt. *(Jonathan Falconer collection)*



LEFT A watertight 20mm ammunition canister positioned on the bridge.

During the early months of the war, the 20mm gun was repositioned to the aft end of the conning tower and all subsequent Type VII boats were built in this configuration. After modifications to enable them to withstand seawater below and above the surface, it was also decided to leave re-sited guns in permanent positions, instead of dismantling and stowing them away prior to diving. A second C/30 20mm weapon was also added.

Guns were normally mounted to be operated by three-man gun crews. The firing rate was 120 rounds per minute. At the start of the war the weapon was located aft of the tower and served its purpose up to a point, but its low rate of fire rendered it ineffective when under attack. In later years, the conning tower was remodelled across four different improvement programmes, making way for better guns offering enhanced defence.

To provide better elevation for gun crews aiming to attack enemy aircraft, guns were remounted on a circular flak platform on the foredeck in front of the conning tower. Deck plates surrounding the mount were fitted with 2cm-wide friction strips made from textured material to provide securer footing for gun crews in rough weather.

Gun crews consisted of aimers, layers and loaders working under the supervision of the *Leutnant zur See* (second watch officer). Aimers and loaders stood next to each other at the gunsight armed with waist-high padded open harnesses, allowing them to lean forward into the gun. But control wheels for the gun beyond the harness often caused the weapon to move up and down and side to side, in even the calmest of weather. The aimer's position behind the gunsight and directly in line with the weapon, allowed him to take responsibility for its horizontal deflection. The layer was able to look down the gunsight at an angle and ensure that the weapon was secured at the correct

LEFT A smaller watertight ammunition canister set into the deck flooring.

RIGHT Type VII gun crews consisted of aimers, layers and loaders working under the supervision of the *Leutnant zur See* second watch officer. The picture shows an aimer and loader standing next to each other wearing waist-high padded open harnesses giving them stability on rough seas and allowing them to lean forward into the gun. *(Jan Van Den Beemd)*

elevation, allowing him to control the range of the shot. The loader's position was behind the gun barrel and his job was to open the breech, load shells and eject spent casings. All three gun crew could use leather straps to attach themselves to the gun mount in rough weather to prevent themselves being washed overboard.

Additional crewmen were on hand to pass shells from the control room floor up to the conning tower and on to the upper deck. A small watertight locker placed near the gun held more rounds ready for use, providing an advantage during the first minutes of engagement.

Shells used in flak guns were single-piece rounds combining the projectile and a brass cartridge case filled with propellant charges. Each round weighed 9.5kg and the effective rate of fire was 15–18 rounds per minute. The maximum range of the gun was 11km.

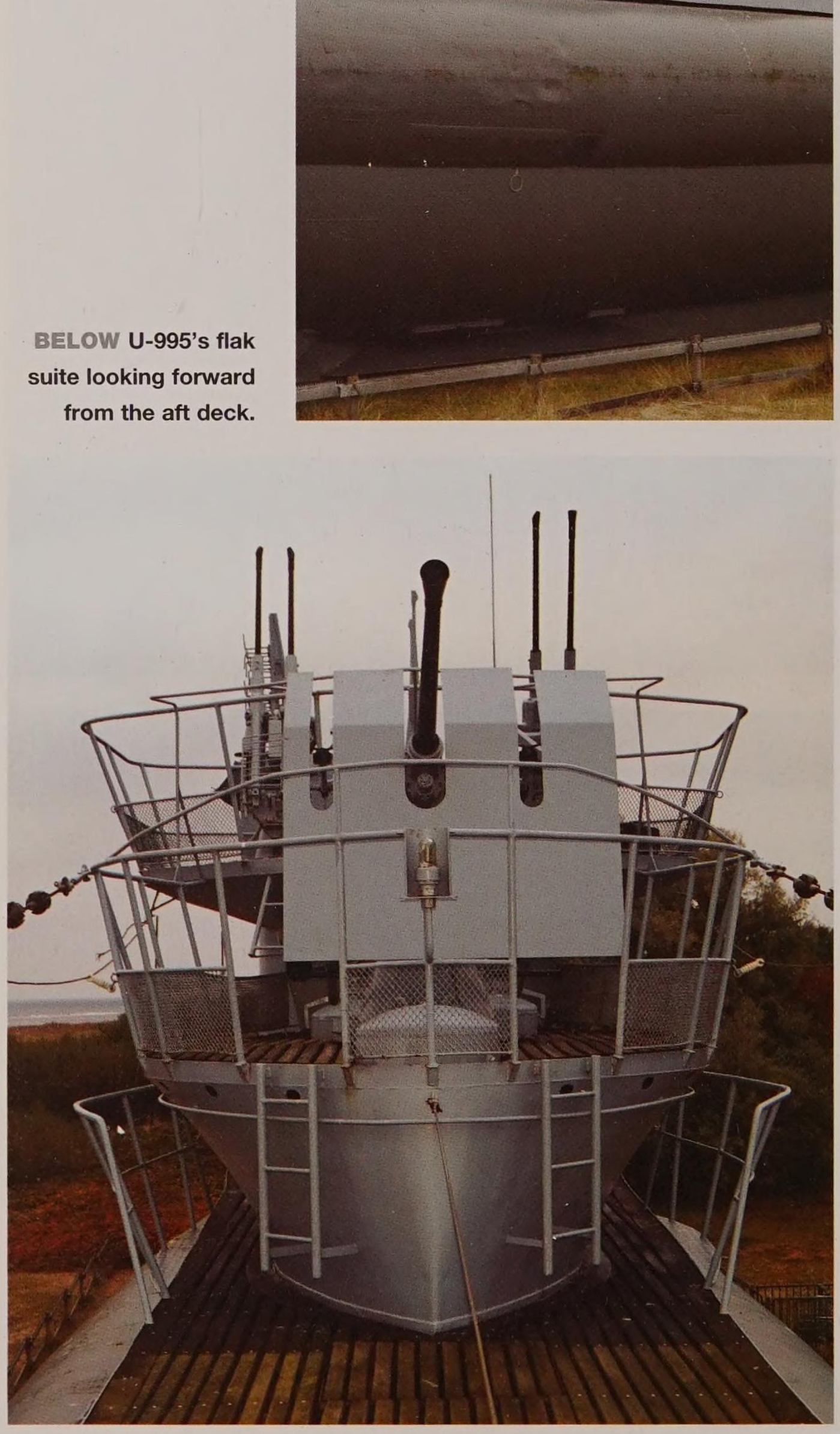
Operating the gun called for a highly complex sequence of actions to be quickly undertaken, which crews practised every day while the submarine was on the surface. Gun crews were called on deck by the commanding officer, bringing with them the gunsight normally kept below. They then rapidly performed various functions to prepare the gun for firing which, through practice, could be achieved in less than a minute, including removing the gun's muzzle, opening containers and chambers to load the first round of ammunition and receiving extra ammunition passed up from below. The duties were also practised daily in reverse in readiness for the need to dive quickly.

By mid-1942 increasing enemy air attacks on U-boats forced the Kriegsmarine to consider how the Type VII's flak defence suite could be improved and the role of flak guns and their position on the deck were revised and upgraded. This resulted in the conning tower area being redesigned several times to give

LEFT A wave washes the deck of U-103 while two gun crew members perform emergency repairs to their 37mm SK AA gun. *(Jan Van Den Beemd)*

RIGHT ***Turmumbau*** **and** ***Wintergarten*****.**

BELOW U-995's flak suite looking forward from the aft deck.

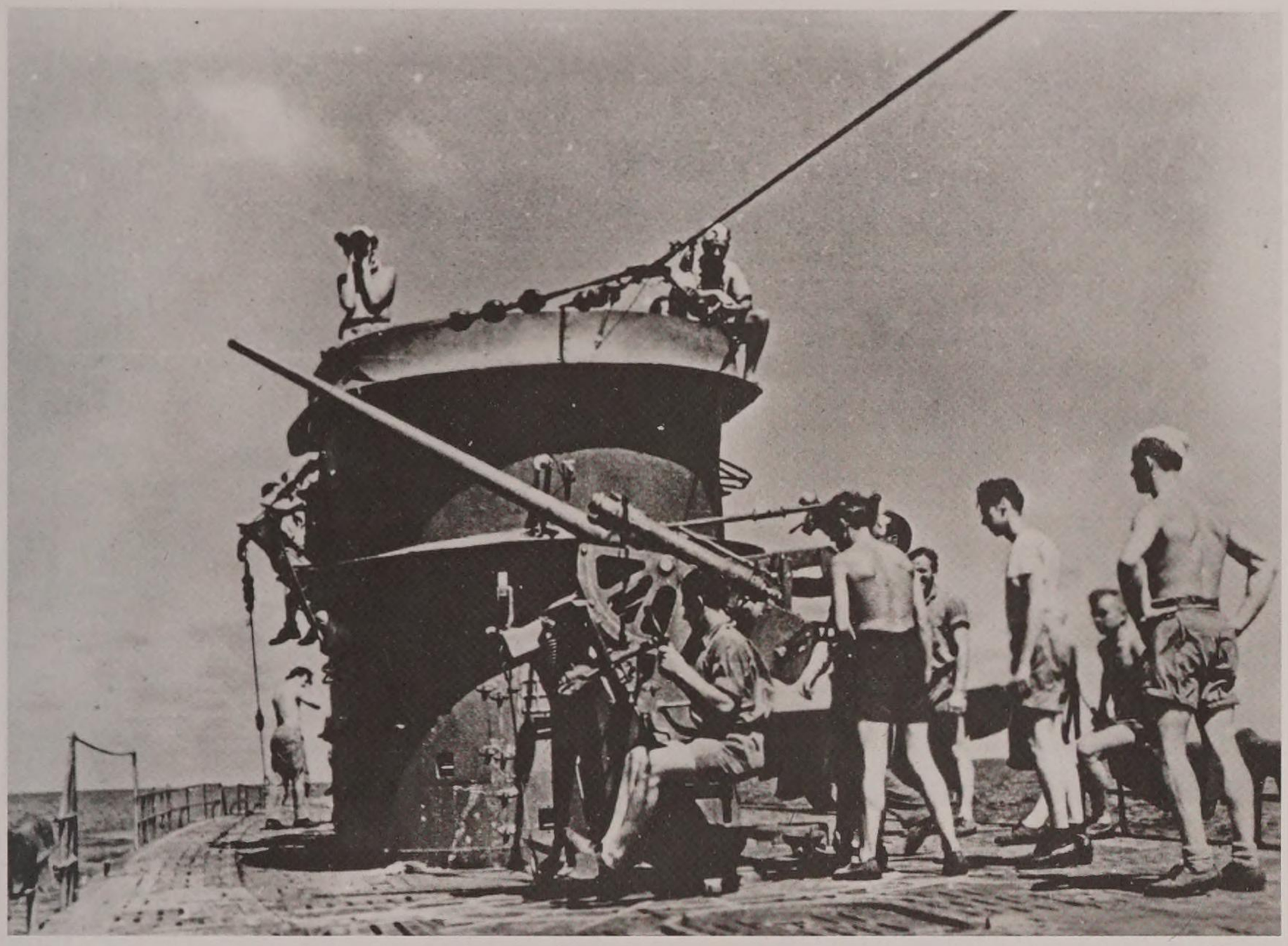


better defence through a programme given different numeric codes under the umbrella name '*Turm*' derived from '***Turmumbau***', the German name for to the conning tower and known as '*Turm*' for short. Submarine crews, however, referred to conning tower extensions as the '*Musikkapellentribüne*' or the '**bandstand**' thanks to its appearance, which looked similar to the bandstands performed at by brass musicians in every German public park.

During the early years of the war, the single 20mm anti-aircraft gun carried on all Type VIIs proved inadequate for the needs of submarine crews faced with attacking enemy aircraft. The first conning tower modifications saw the addition of a circular platform to the aft of the tower to house the weapon. The platform was later widened and the flak gun replaced with mounts for two twin-20mm MG151 small, low-velocity cannon, originally developed for the Luftwaffe. As soon as materials became available, U-boats received a second, lower flak platform, installed and widened to the aft of the conning tower and known to U-boat crews as the '***Wintergarten***' or 'winter garden' – a name often used by German people to describe a conservatory area at the rear of a domestic house. The platform housed twin-20mm C/30 mountings below and aft of the existing one. Until the twin mount was available, boats kept their single-20mm C/30 on U-boats patrolling the Mediterranean in 1942 to 1943. This arrangement became the basic flak defence suite known as '*Turm 1*'.

Type VIIC boat U-553 was used as a prototype for the new flak suite and failed all tests. Even the C/30 was found to be barely adequate due to its poor reliability record. The shape and size of the *Wintergarten* was found to generate extra spray, which increased the boat's surface visibility and when submerged its hydrodynamic effects made depth maintenance more difficult. In September 1942, Dönitz told Hitler that the MG151 was inadequate because of its poor range and lack of penetrating power. Dönitz was told to install more reliable 20mm C/38 cannon to U-boats until the new 3.7cm cannon – originally developed for the Heer (Army) – was ready.

A submarine version of the Heer's 20mm quadruple mounts – known as *Flakvierling* –



LEFT Gun crews practising on a 37mm flak gun used on Type VII and Type IX U-boats. It was fixed on an LM42U mount. *(Jonathan Falconer collection)*

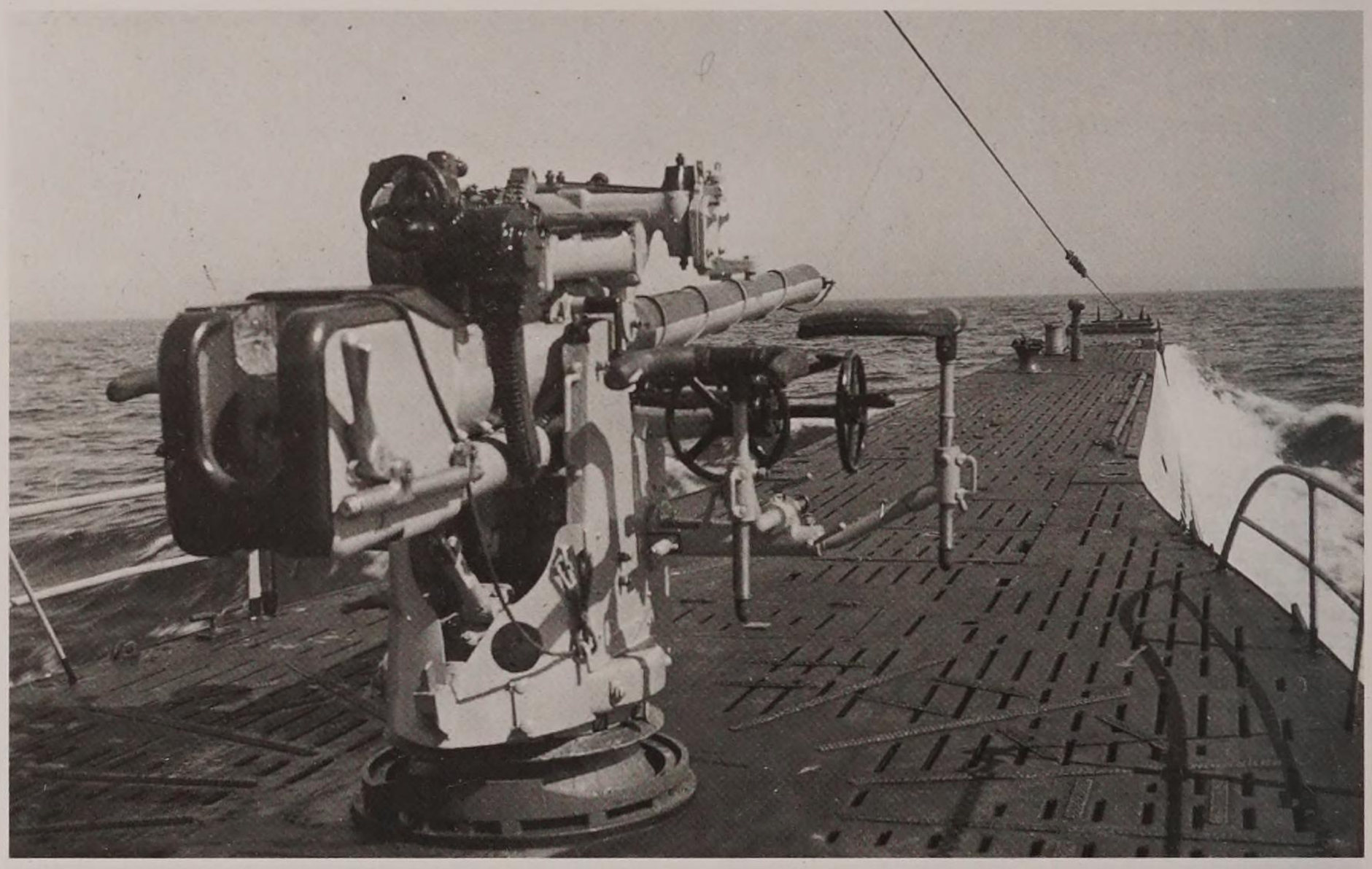
became another experimental U-boat weapon, resulting in a second flak suite being developed and known as *Turm 2.* This comprised a pair of twin-20mm C/38 mounts on the upper flak platform and a 20mm *Flakvierling* (later to be replaced with a 3.7cm mount when ready) on the *Wintergarten*. Because neither twin nor quadruple mounts were available, a single C/38 was positioned on the flak platform and another on the *Wintergarten*. Both were used on an interim basis.

Fitting *Turm 2* flak suites to Type VII boats commenced in December 1941 and after successfully testing the new weapons they were installed on to 48 boats. Submarine U-758 pronounced the flak suite a 'complete success' and by August, 150 Type VII had taken delivery of their new cannon.

Turm 3 was a little-used configuration that saw some Type VIIs fitted with the 20mm C/38 on a widened bridge area and it was expected that VIID minelaying boats could also take the suite. However, the idea was scrapped as the VIIDs were fitted with mine shafts aft of the tower and could not accommodate the larger *Wintergarten* feature from the *Turm 2* scheme.

By early 1943, the situation in the Bay of Biscay had deteriorated to such a point that Dönitz introduced 'stop-gap' measures to protect his U-boats until extended bridge and increased flak armament could be installed on to all boats. Extra *Flakvierling* mounts were fitted along with the first experimental 37mm gun on U-441, a specially converted Type VIIC designed as an air defence boat to combat the enemy on equal terms. U-441 was the first of seven *U-Flak* boats to install the conversion and changes in appearance included an expanded *Wintergarten* and an additional gun platform positioned directly in front of the conning tower. As the boat was to act as an 'aircraft trap', it received increased firepower in the form of two 20mm quadruple anti-aircraft machine guns and one 37mm machine gun, plus an additional MG-42 gun. It would also carry a battery of 8.6cm high-explosive rockets, to be fired from multiple launchers. This increase in anti-aircraft weapons needed additional manpower and the normal 44–48-man crew was boosted to 67 on board. In May 1943 Admiral Dönitz inspected the boat and was pleased with what he saw. He gave it the new name **U-Flak 1**.

Dönitz ordered six more *U-Flak* boats to be converted from Type VII boats, but they met with limited success. While on patrol in waters to the west of Ireland, U-441 made its first 'kill'



RIGHT The naval 88mm cannon installed on some Type VII class U-boats was a single-unit round (projectile and cartridge) weapon. Mounted on a platform just ahead of the conning tower, it had identical controls on both sides allowing a crew of two to operate it from either side. *(Through Their Eyes)*

when it shot down an RAF Sunderland and its crew of 11 during an attack run. This became a story for which Dr Goebbels really went to town as an excuse to extol the virtues of *U-Flak* boats. What the propaganda minister failed to tell the German public, though, was that the Sunderland had dropped five depth charges before it crashed into the sea, damaging U-441. This forced the vessel to limp back to base in Brest, where it was taken out of action for two months while undergoing repairs.

The most common '*Turm*' U-boat configuration was *Turm 4*, which saw Type VII boats fitted with two twin-20mm guns installed on to a widened upper platform alongside a single four-barrelled 20mm flak gun. *Turm 5* saw U-362 turned into an experimental boat with two twin-20mm flak guns on the upper platform, a single twin-20mm flak gun on the lower platform and a fourth twin-20mm gun positioned on a platform in front of the conning tower.

The final two '*Turm*' projects were either modifications of previous systems or ideas that only ever appeared on the drawing board. *Turm 6* involved just two U-boats – U-673 and U-973 – receiving single-barrelled 37mm flak guns on their lower platforms, two twin-20mm flak guns on their upper and single twin-20mm cannon in front of the tower and positioned on their own pedestal.

The original idea behind *Turm 7* was to install twin-37mm flak guns on to platforms positioned to the aft and directly in front of the conning tower, but the plan never came to fruition. The Kriegsmarine was forced to admit that the *U-Flak* boats were flawed and of little value in the Bay of Biscay and North Atlantic. They were eventually scrapped and converted back to original Type VIIC designs.

Later Type VII boats were fitted with more reliable 88mm and 105mm deck guns, which fired 12–14kg rounds. Although not intended as a primary anti-aircraft weapon, the 88mm *Schiffskanone* deck gun was used in that role.

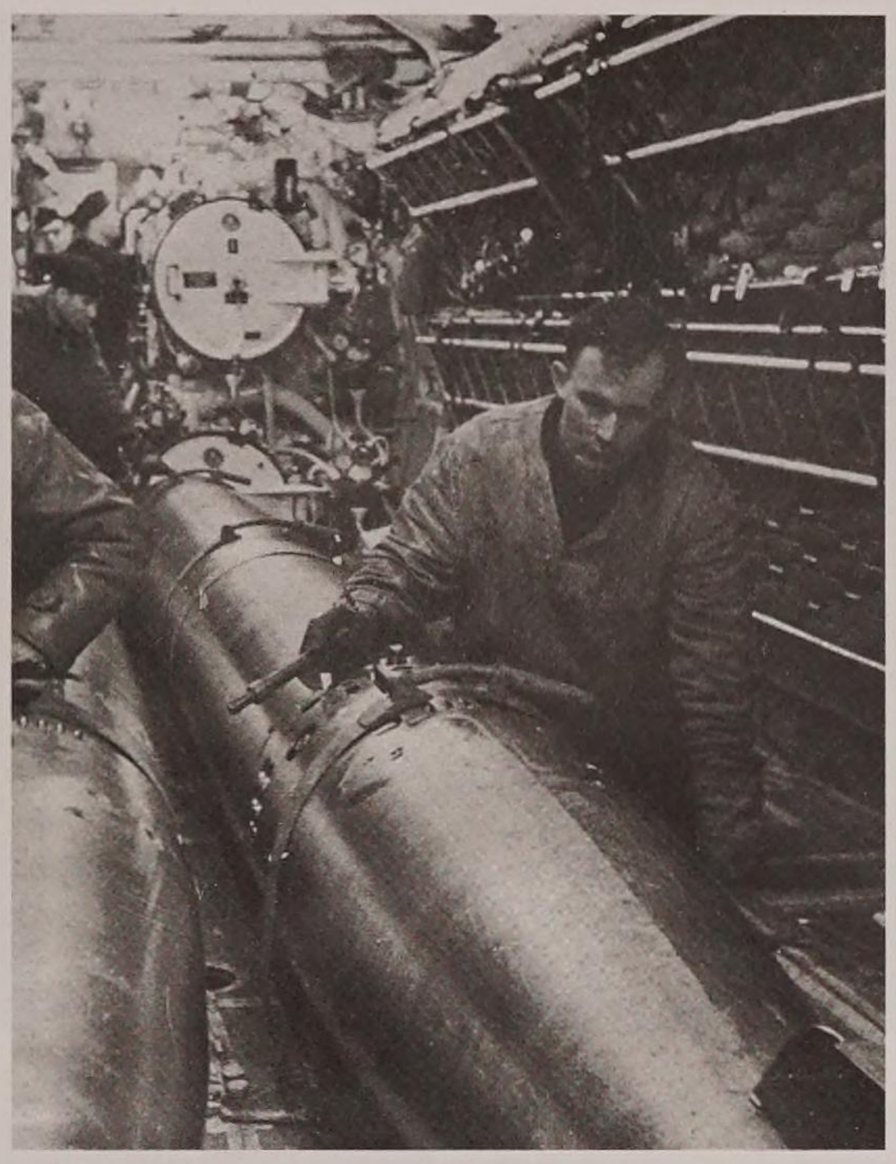
The 88mm gun was mounted on a low box forward of the conning tower. It could traverse through a field of 360°. The weapon's -4° depressed parameter and 30° elevation capacity were two of its most impressive features. The gun fired a 13.7kg high-explosive shell at a 700m/sec muzzle velocity and had a solid impact range of over 12,000m.

Operated by the usual three-man team, the gun made a powerful horizontal weapon that, when used against enemy surface ships, caused heavy damage. But as U-boats began to sustain alarming losses caused by enemy air attack, U-boat gun crews began turning the 88mm weapon on enemy planes. Although use on attacking aircraft had not been tested before the war, the gun performed well, achieving a number of enemy aircraft 'kills'.

Fully automatic, clip-fed 20mm or 37mm guns used elaborate and complex mechanisms to train and aim the weapons and deal with recoil. To keep them in full working order, 15 different external grease fittings covered the weapons. They could also be serviced at sea using a grease gun, which eliminated the need to dismantle them. These guns had both barrel plugs and breech plugs, which had to be removed before firing and replaced before diving.

By November 1943 all '*U-Flaks*' had been converted back to standard attack boats fitted with standard anti-aircraft armament. Records show that only six aircraft were shot down by '*U-Flaks*' in six missions, three by U-441, and one each by U-256, U-621 and U-953.

Around 120 aircraft were shot down by U-boats for the loss of roughly 30 U-boats either sunk during attack or once being located by other forces shortly afterwards and sunk. Following the massive anti-submarine build-up by the Allies in 1942/43, deck guns had been removed from almost all German submarines by 1943/44.

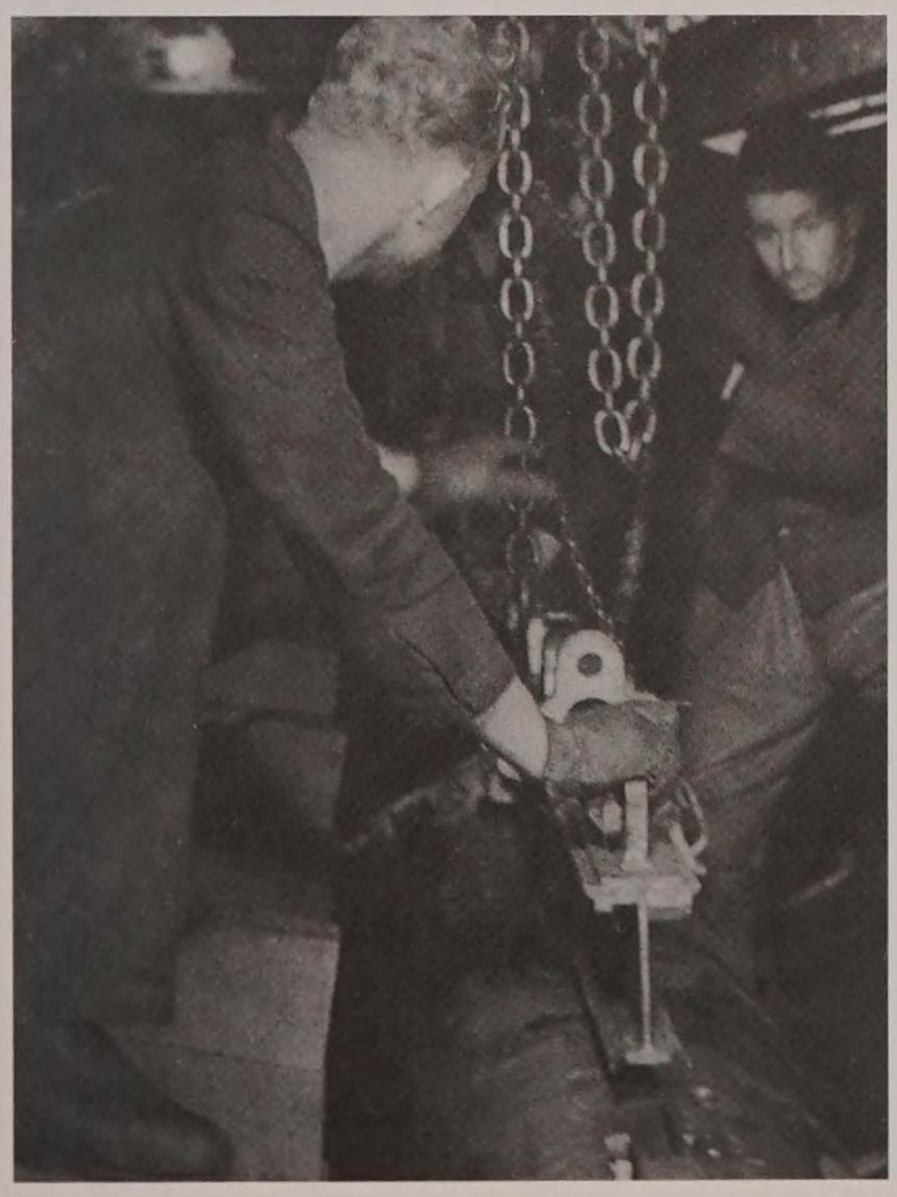


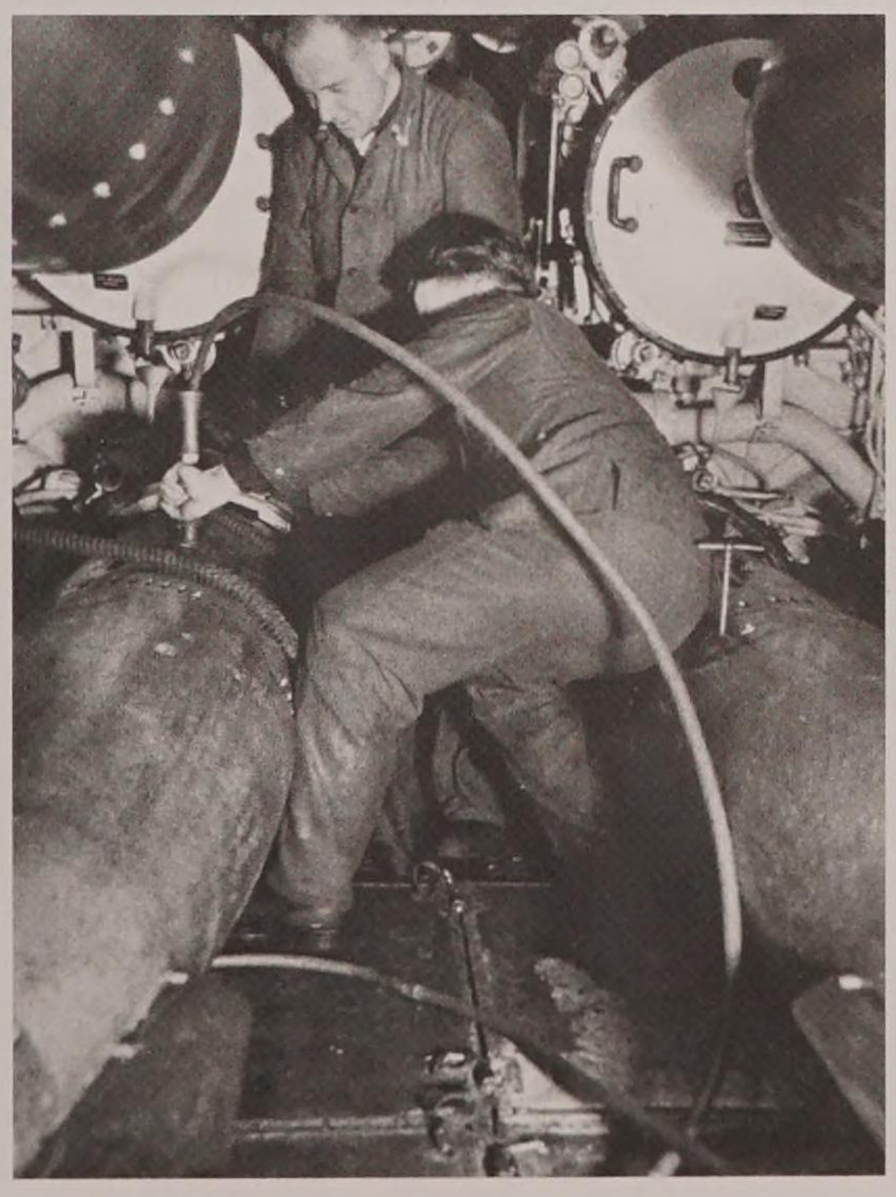
LEFT Torpedo testing and loading exercises took place every day during war patrols. *(Peter Westerwelle)*

Eels, torpedoes and mines

Throughout the war, Type VII class U-boats carried a variety of different **torpedoes** in a bid to give them tactical advantage in attacks on well-defended targets. As the time available to U-boat men to aim torpedoes was reduced by aggressive enemy defences, the ability to find targets was, out of necessity, transferred to the torpedo itself to find its target.

Type VII boats were equipped with four forward torpedo tubes and one aft, whose diameter was 553mm and length 7,552mm. Two-thirds of the length of the tubes was located outside the pressure hull and supported by the ends of the pressure hull and by torpedo





FAR LEFT Reloading a torpedo tube in U-373's cramped conditions. *(Peter Westerwelle)*

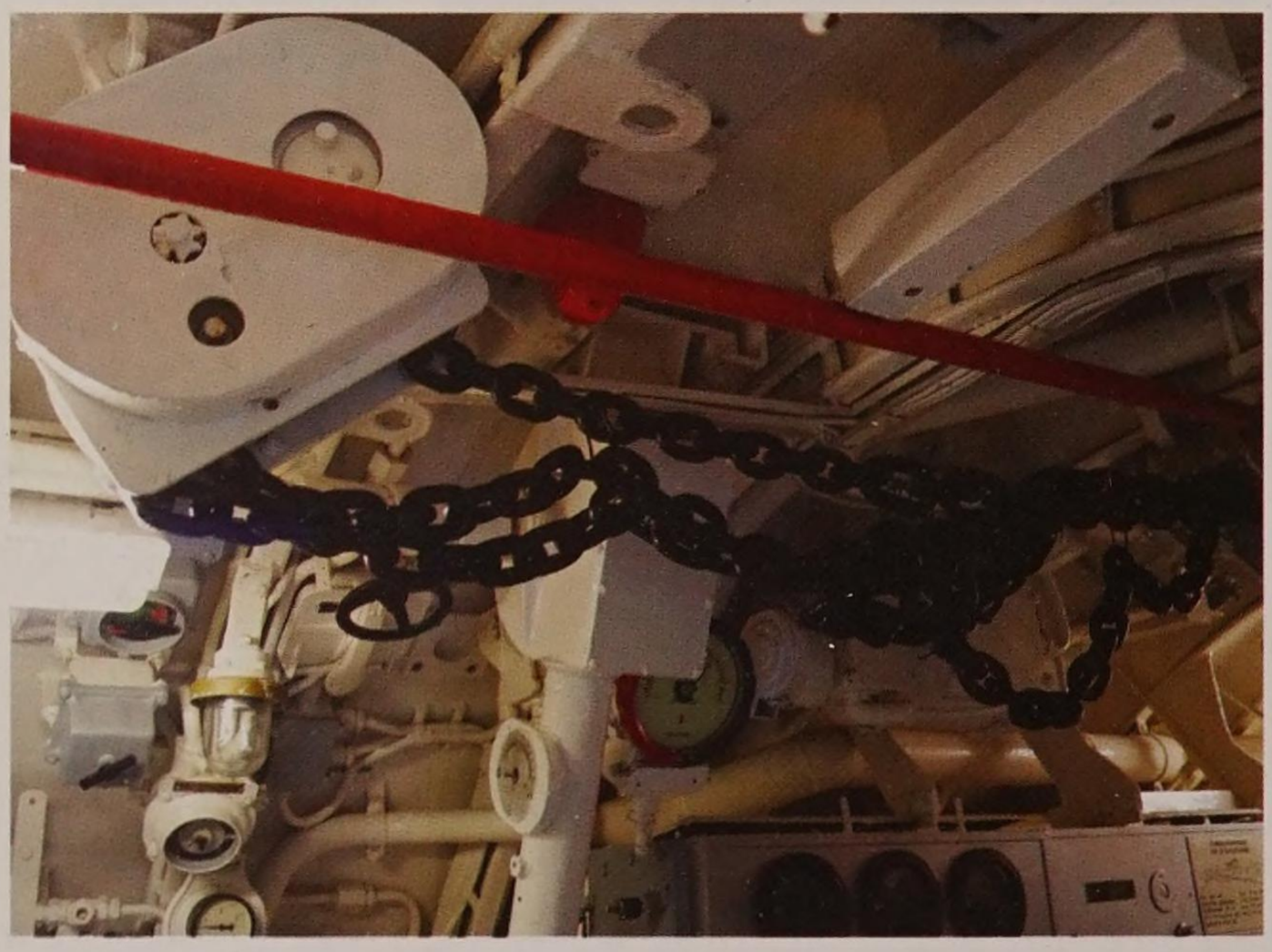
LEFT The cramped and confined conditions of a U-boat torpedo room. *(Triangle)*

ABOVE The aft torpedo launch tube inside U-995.

bulkheads in the bow and aft parts of the outer shell. Torpedo launches took place by means of compressed air.

Tubes consisted of forward, middle and aft sections, joined together by means of flanges and bolts. The forward part was closed with an outer door which opened on to a vertical axis towards amidships. A breech door located at the inner end of the tube was closed and secured by a locking ring. The interlock mechanism between breech and outer door operating gears prevented simultaneous opening. The tubes were fitted with gears for setting the desired depth, speed and gyro angle of a loaded torpedo during attack approach.

BELOW Some torpedoes were hung from an overhead hoist and secured into position using loading pulleys and chains attached to the ceiling.

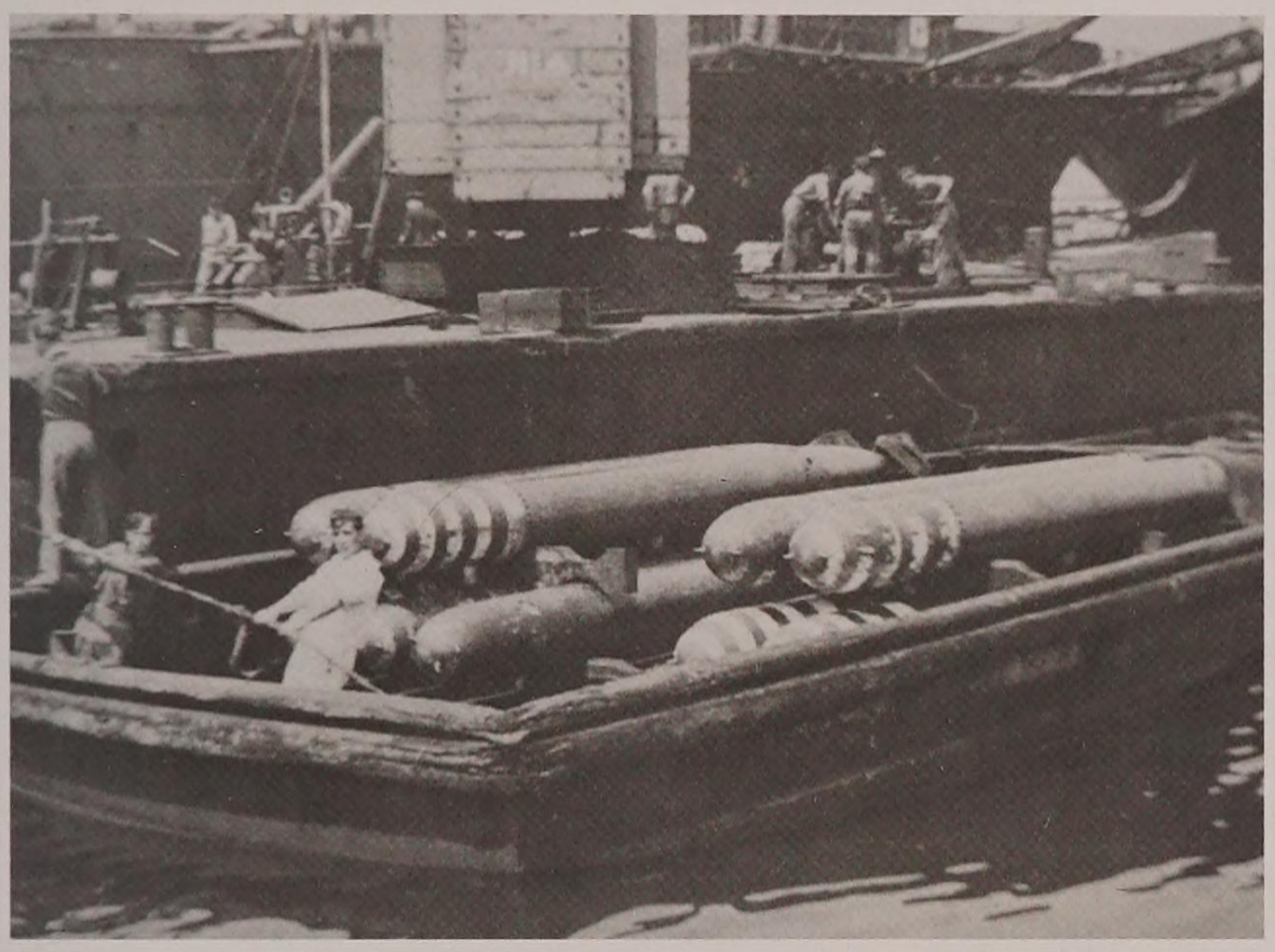


The air impulse tank capacity was 220 litres and was used to provide compressed air for torpedo launches. During a launch, the firing rod gear retracted the torpedo stop bolts and admitted air into the tube. To avoid the appearance of air bubbles, which could betray the boat's position, a suppressor was fitted.

A piston weighing 75lb was placed behind the torpedo after loading. For submerged firing, the torpedo was fired by compressed air at a pressure of approximately 24 atmospheres acting against the piston, which forced the torpedo from the tube at a speed of 10m per second. A relief valve automatically opened at the back of the tube and water pressure would force the piston back to its original position, venting the compressed air back into the boat. For surfaced firing, the compressed air was directed behind the torpedo by means of a changeover cock, which also locked the piston to the tube. The forward inner tube door was then closed and water drained into the bilge.

U-boat crews gave their torpedoes the slang name of 'eels' due to their greasy and shiny appearance once they had been covered with thick brown industrial grease. Handling torpedoes was one of the dirtiest and most strenuous jobs on a U-boat. The grease provided a thick protective layer to help them slide easily into torpedo tubes and slip through water with less drag. They were loaded from land or from ships by means of a port or ship crane, or from water by means of a portable crane mounted on the forward upper deck on the port side or on the aft deck on either side of the torpedo galley hatch. Crew members known as 'torpedo boys' were in charge of loading operations. Transport splints with gear racks were installed on the boat, each splint equipped with two trolleys. The torpedo was attached to these trolleys by means of steel bands and moved longitudinally by an aft trolley fitted with a gear rack and crank arm. Mines were loaded using the same equipment.

The G7a (TI) torpedo was the standard-issue torpedo for all U-boats and surface torpedo-bearing war vessels. They measured 533.4mm in diameter and 7,163mm in length, with the warhead holding a charge of approximately 280kg of Hexanite, a German military explosive. The torpedo was of a straight-running unguided



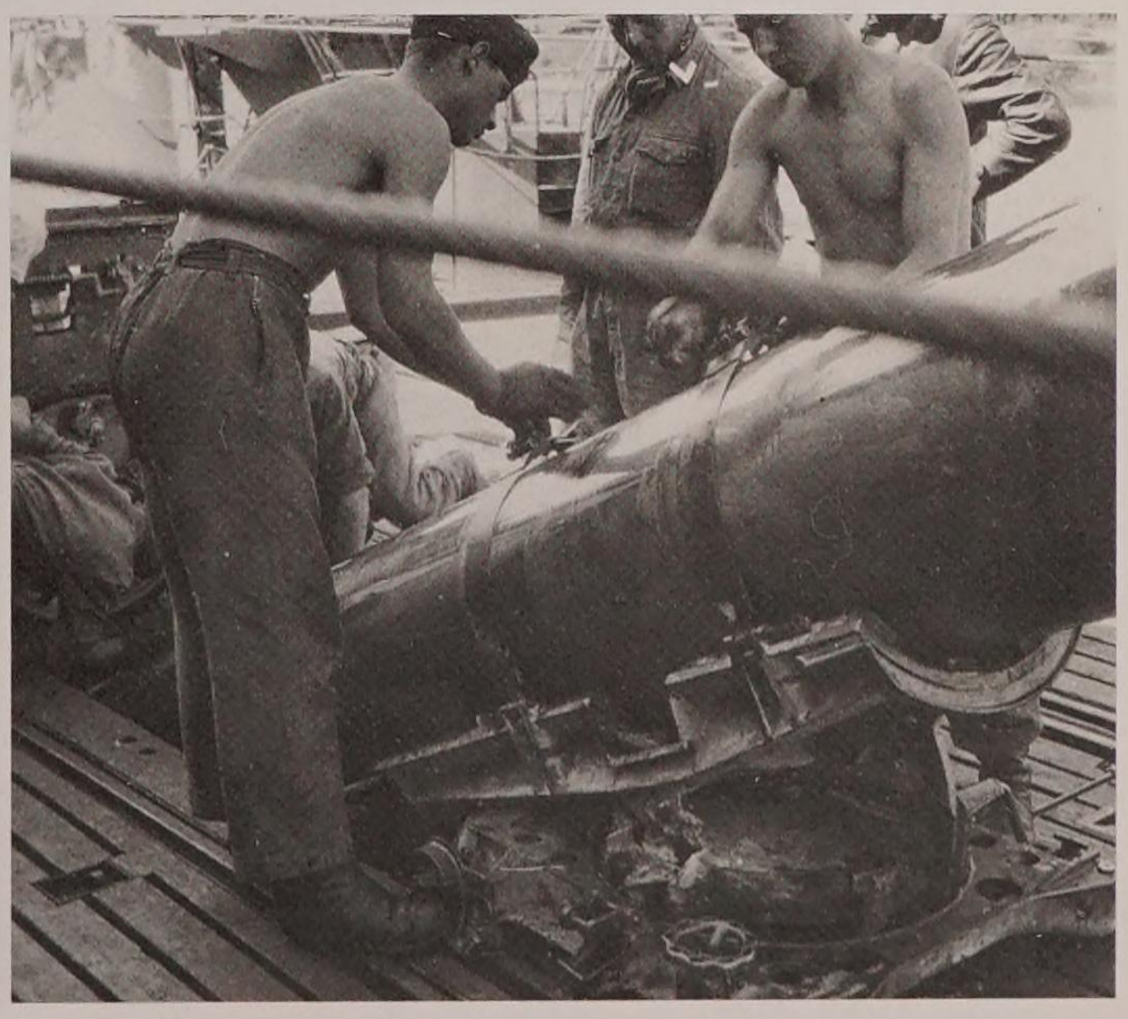
TOP LEFT **A barge full of 'eels' being transferred from a shore base to a U-boat.** *(Peter Westerwelle)*

ABOVE **Gently does it! Loading torpedoes on to U-142.** *(Through Their Eyes)*

LEFT **Torpedoes being transferred by a floating crane to a waiting U-boat.** *(Triangle)*

BELOW LEFT **Lowering torpedoes into the front torpedo stowage hatch on U-390.** *(Through Their Eyes)*

BELOW **Torpedo boys loading an 'eel' into a Type VIIA.** *(Through Their Eyes)*



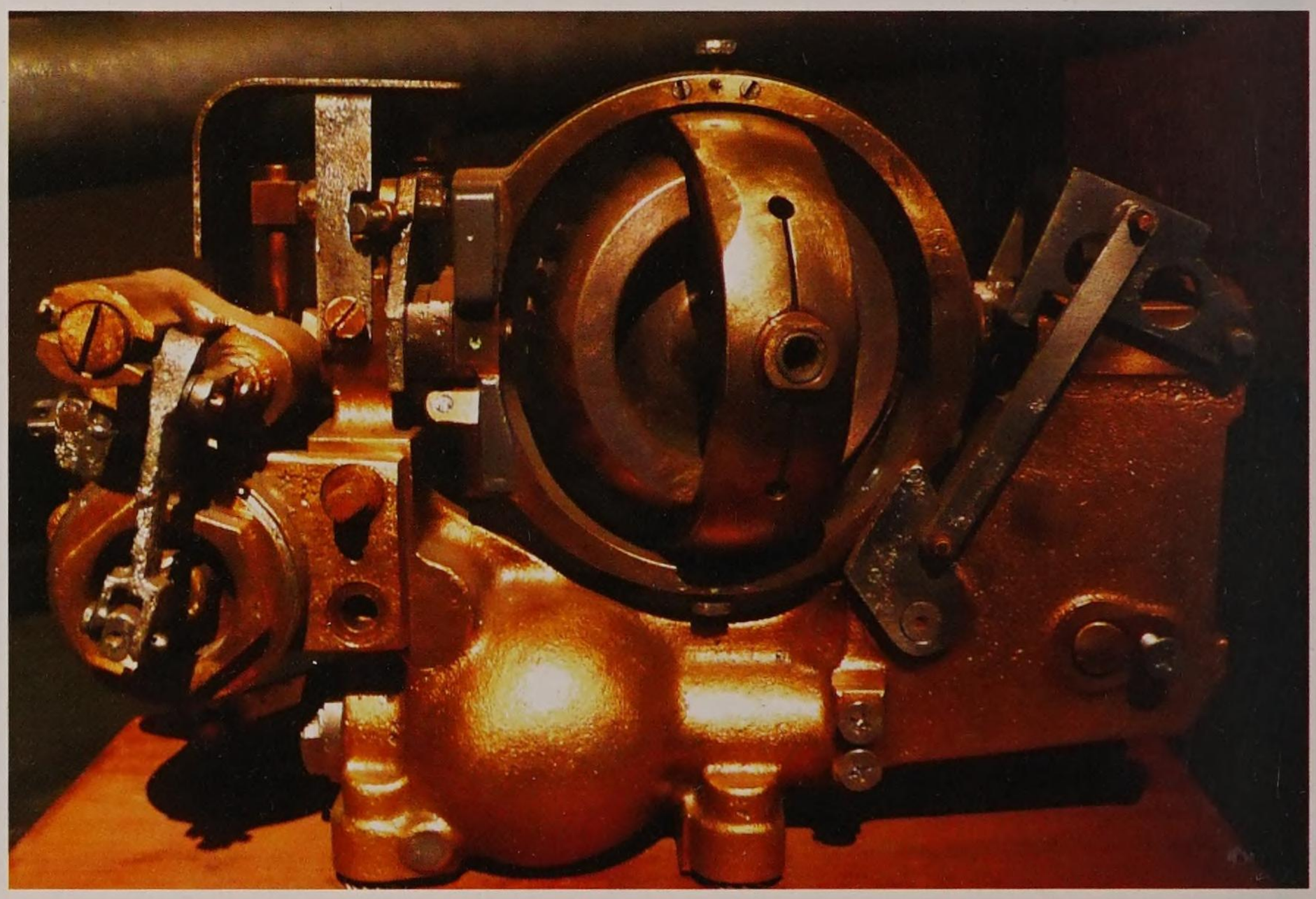
design, controlled by a gyroscope. The G7a (TI) was of variable speed, running a distance of 5,000m at 81km/h, 7,500m at 74km/h and 12,000m at 55.6km/h.

The G7a (TI) was the last naval torpedo of German design to use a wet heat method of propulsion. It was powered by a steam engine fed by a mixture of compressed air and steam. The fuel decalin burned in a combustion chamber, creating steam from fresh water. The torpedo's speed was determined by the level of pressure from the low-pressure regulator feeding air to the bottom of the combustion chamber. The resulting superheated steam powered a 4-cylinder reciprocating engine, in turn powering a pair of contra-rotating propellers.

This system of propulsion gave the G7a (TI) speed and endurance – the greatest of any production model German torpedo of the Second World War – but had the disadvantage of being noisy and leaving a long wake of bubbles, common to most torpedoes of the period. For U-boats, this relegated the G7a (TI) to use mainly at night when its wake was least noticeable and not likely to give away to the enemy the location of the submarine that fired it.

By the end of the war, 3,000 Allied ships (175 warships and 2,825 merchant vessels) had been sunk by torpedoes fired from U-boats. Early Second World War German torpedoes were straight-runners, as opposed to homing and pattern-running torpedoes introduced later in the war. They were fitted with one of two types of pistol trigger: *impact*, which detonated the warhead upon contact with a solid object and *magnetic*, which detonated upon sensing a change in the magnetic field within a few metres. One of the most effective uses of magnetic pistols was to set the torpedo's depth to just beneath the keel of the target. The explosion under the target's keel would create a shockwave and the ship would break in two. In this way, even large or heavily armoured ships could be sunk or disabled with a single well-placed hit. In practice, however, the depth-keeping equipment and magnetic and contact exploders were notoriously unreliable during the first eight months of the war. Torpedoes would often run at an improper depth, detonate prematurely or fail to explode altogether – sometimes bouncing harmlessly off the hull of a target ship.

Later in the war, Germany developed an acoustic homing torpedo, the G7/T5. It was primarily designed to combat convoy escorts and designed to run straight to an arming distance of 400m and then turn toward the



RIGHT The gyroscope of a G7a torpedo. *(International Maritime Museum, Hamburg)*

loudest noise detected. This sometimes ended up being the U-boat itself; at least two submarines may have been sunk by their own homing torpedoes. Additionally, it was found these torpedoes were only effective against ships moving faster than 15 knots (28km/h).

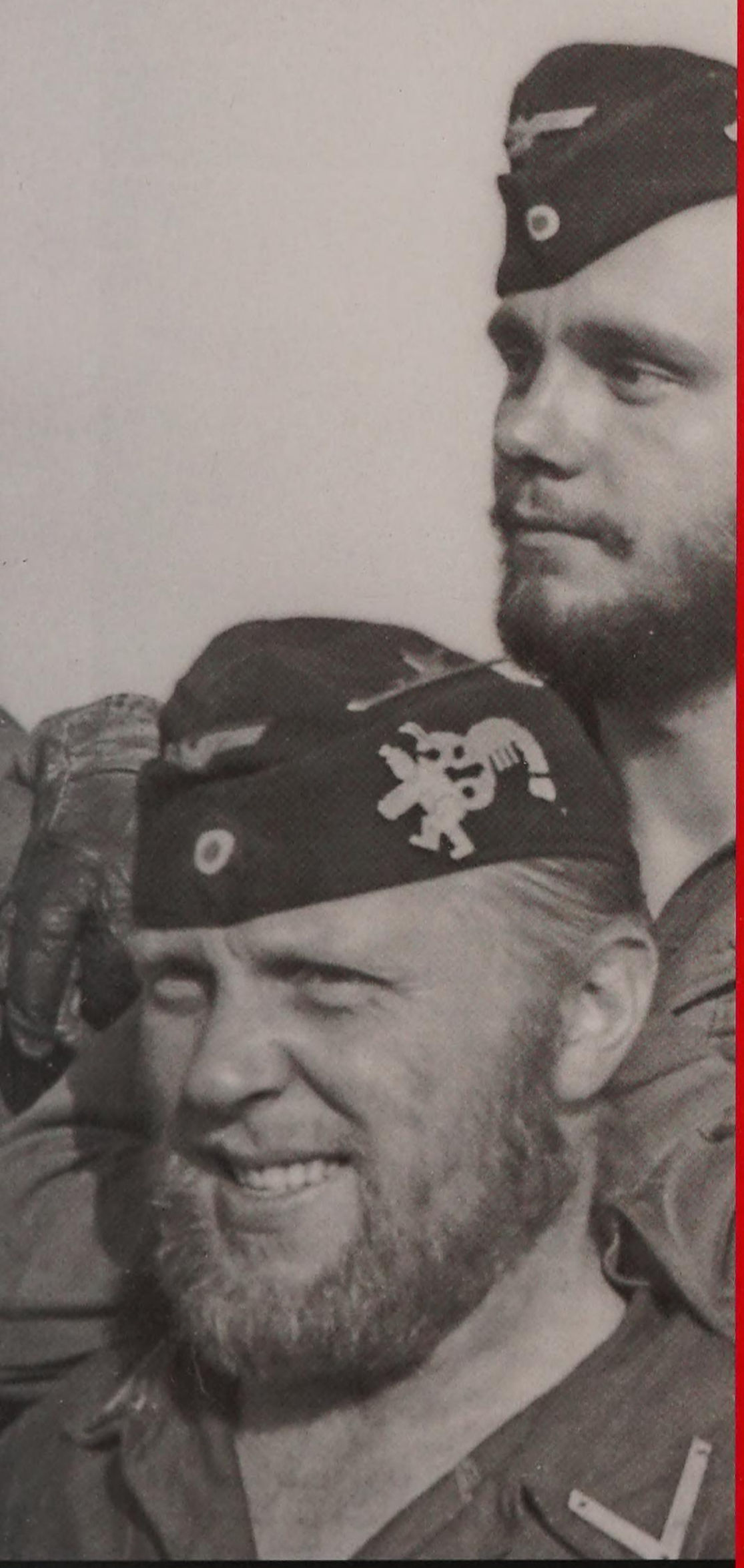
U-boats also adopted several types of 'pattern-running' torpedoes, which ran straight out to a preset distance, then travelled in either a circular or ladder-like pattern. When fired at a convoy, this increased the probability of a hit if the weapon missed its primary target.

The **submarine mine** during the Second World War was an efficient and dangerous weapon if properly used. Minesweeping was expensive and time-consuming for the defenders, diverting submarine crews from other duties.

In the period prior to the outbreak of war, the German Navy developed in secrecy a series of mines that were superior to those used in the previous conflict. They were laid during hundreds of operations although Dönitz did not favour them as they were not as effective as torpedoes. The main mines included:

- **TMA** – large floating submarine mines, redesigned as the TMC in late 1939.
- **TMB** – designed especially for submarine use. This was a seabed mine that sat on the sea bottom and utilised a magnetic pistol. It was 2.2m long and carried an explosive charge of 578kg – twice that of a torpedo at the time. It was laid on the bottom in shallow seaways and detonated when a ship passed over its position. Few ships survived such a blast under their keel. All mines were originally laid at a 30m depth, but following reliability questions and testing it was later established that 25m was a more lethal depth. The mines were also overly sensitive, sinking smaller ships instead of larger ones for which they were originally intended. U-boat crews thus started laying them in even shallower waters and de-magnetising them to reduce their sensitivity. This improved their score.
- **TMC** – a ground variant of the floating TMA mine, designed after Dönitz expressed concerns that the 578kg warhead of the TMB might not be powerful enough against big ships such as enemy battleships and aircraft carriers. Unlike the torpedo directorate that acted slowly on reliability complaints, mine designers were willing to improve their work. They delivered the TMC with a massive explosive charge of 999kg, which was lethal up to 36m.

LEFT Mines being loaded on to a pontoon before being taken out to a Type VIID mine-laying U-boat. *(Through Their Eyes)*



Chapter Five

Type VII crew

'It is my job as a submarine Commander to sink ships. To do this, I need a co-operative crew so that everything clicks. If the men are ready to co-operate, they not only have to know their jobs well – all the little details of their daily routine – but they also have to like their work.'

Korvettenkapitän Wolfgang Lüth, Weimar, December 1943.

OPPOSITE **The bearded crew of Type VIIC U-653 pose for the photographer at their home base of Brest on the French Atlantic coast. The boat's emblem (seen on the crew's caps) shows a lobster biting Churchill. U-653 was sunk in the North Atlantic by depth charges dropped from a Swordfish biplane torpedo bomber flying off the British escort carrier HMS *Vindex* on 15 March 1944. All hands were lost.** *(Bundesarchiv)*

LEFT A February 1943 edition of the German magazine *Kolonie und Heimat* (Colony and Home) carrying a cover story about the building and launching of a new U-boat, its trials and first patrols. The cover shows a trio of submariners hoisting their colours on to the conning tower mast to celebrate 'the birth' of their new Type VII submarine. The magazine carried numerous stories about different aspects of Germany's war effort, including articles on the Kriegsmarine, Hitler Youth and victory on the Eastern Front. Only seven issues were produced before it ceased publication.

DIE
ERSTES SEPTEMBERHEFT 1944
Heft 17
KRIEGSMARINE
Großadmiral Dönitz beglückwünscht den erfolgreichsten Einzelkämpfer des Ein-Mann-Torpedos, Schreibersmaat, Ritterkreuzträger Walter Gerhold in seinem Hauptquartier

BELOW Less than one month into the war Type VIIA U-35 and its crew became the cover story of *Life Magazine* in October 1939. The following month U-35 was scuttled by its crew in the North Sea following a depth-charge attack from the British destroyers *Kingston, Icarus* and *Kashmir.* Lord Louis Mountbatten, commanding the British squadron, took the extraordinary step of stopping his ships for an extended period and sending out rescue boats for U-35's crew adrift in the water. Consequently – and unusual among U-boats lost during the war – all 43 hands on board survived and were taken prisoner. *(Life Magazine)*

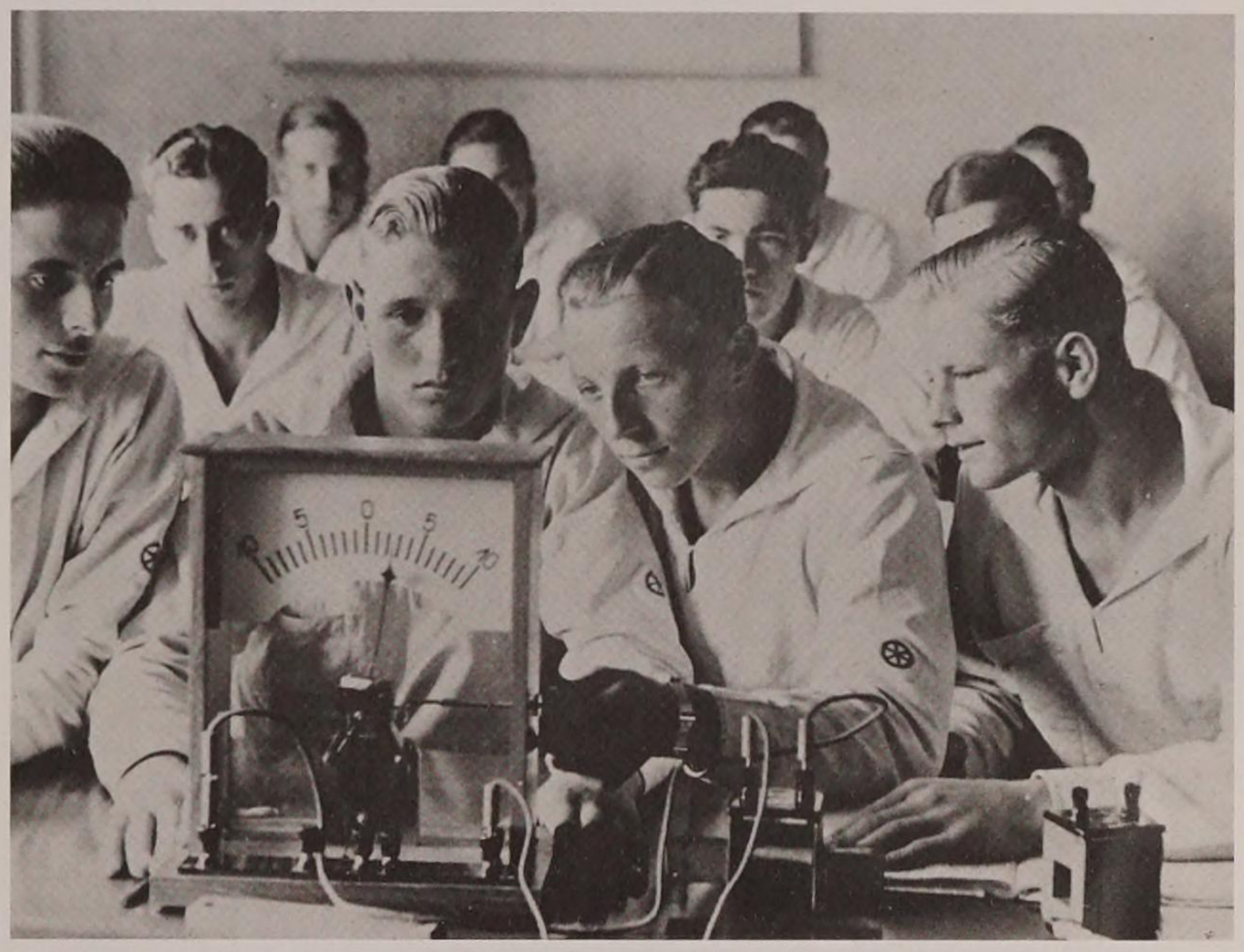
ABOVE A September 1944 edition of *Die Kriegsmarine*, a 12-page popular monthly magazine for crew serving on U-boats and surface vessels. The magazine was always packed with stories about heroism and the cover of this issue shows a photograph of Grand Admiral Dönitz presenting 23-year-old private first-class sailor Walter Gerhold with the Knight's Cross of the Iron Cross for his successful 'one-man torpedo' mini submarine attack on a Polish cruiser. The 'one-man torpedo' was a standard torpedo attached to another underneath with the top torpedo equipped with a cabin for the driver in place of an explosive device. The driver sat under an acrylic glass dome which provided good visibility on all sides. The craft was unarmed, apart from the torpedo, and was not submersible. The driver fired the single torpedo via a simple sight device. At 05.40 on 5/6 July 1944, Gerhold's one-man torpedo attacked the 5,000-ton Polish cruiser ORP *Dragon* with the loss of 26 men. He became a national hero – but *Die Kriegsmarine* was first with the story and devoted four pages of words and pictures to the attack. In later civilian life, Gerhold went on to become a policeman and later a chief inspector of police. He died in March 2013 at the age of 91. *(Wartime Press)*

Acceptance into the U-boat-Waffe alone carried the prestige of exclusivity. U-boat men were looked up to. They were portrayed in the media as brave and heroic men who showed prowess and self-sacrifice. They reflected everything that was good about German military society. U-boat crews became men on a par with film stars and became national and local heroes in the eyes of the public. A Kriegsmarine wartime publication described U-boat recruits as 'being inspired as if by a sacred calling as they vowed "I swear by Almighty God this sacred oath: I will render unconditional obedience to the Führer of the German Reich and people, Adolph Hitler, Supreme Commander of the Wehrmacht, and, as a brave sailor, I will be ready at any time to stake my life for this oath."'

U-boat crews received initial training in Type II boats before being posted on active service. The first regular course for future commanders, NCOs and crews took place at an academy in Kiel in January 1933. The first three months covered theoretical training including instruction in U-boat construction, learning about maintaining stability, weight distribution and trim maintenance above and below water. They went on to learn about theory and tactics, working of the gyrocompass, underwater sound location and escape apparatus, plus basic training in the practice of firing torpedoes. Officers and senior ratings were also trained in use of the periscope while engineering crew were instructed on diesel and electric propulsion units.

As the U-boat production rate increased, so did the demand for trained crews. The training academy at Kiel had insufficient teaching and accommodation facilities to cope with such a large influx of students, so a second academy was opened in Neustadt (Holstein) in May 1937. In 1938 training boats were introduced into their own flotilla and the following year a special academy of submarine warfare was opened under Dönitz's command.

During the course of the war, Kriegsmarine submarine academies were called on to supply more young men to crew U-boats on active duty. Commenting on the relative youth of submarine crews in October 1943, Dönitz wrote:



ABOVE 'Germany trains men for her U-Boats.' A German publicity photograph from January 1940 and syndicated to the US and European media told readers: 'These young men will be the next to crack England's convoys.' It went on to explain that 'the photos prove how wrong Winston Churchill was when he alleged that Germany lacked replacements for lost submarine crews. This photograph shows cadets at submarine school studying an indicator in an electrical class in a course dealing with the theory and practice of submerged travel. Passed by the German censor.' *(Acme Newspictures Inc., New York)*

> *We shall have to man the majority of submarines with very young recruits. Youth has no shortcomings when there is real manhood within. Youth is unencumbered, youth is healthy. But their training must be all the more thorough, and it is all the more important that the quality of human material recruited into the navy be of the highest.*

Regardless of their age, every single U-boat crew member had a role to play that was important to the operation of their boat. There was no room for slackers or men not prepared to do their bit to ensure victory at sea for the Fatherland. Crew members were ordinary boys from farms and factories, shops and schools across Germany from Aachen, Allstedt and Altdorf to Zwingenberg, Zossen and Zeil am Main and all points in between.

Although the average age of a U-boat sailor was 21, many were younger and most were straight out of school or called out of their first

ABOVE Crewmen from Type VIIC U-586 after its commissioning ceremony on 4 September 1941. The boat would go on to serve on 13 war patrols and become part of 10 wolfpack operations. It sank two ships (total tonnage 12,716grt) before she herself was sunk on 5 July 1944 near Toulon, France, by bombs during an air raid by USAAF B-24 Liberator aircraft. *(Through Their Eyes)*

ABOVE Sending a photograph home to family and friends was a popular pastime for U-boat crews after returning to base. It also sent out the message 'I'm still alive' to loved ones.

jobs and not yet shaving. During the first years of the war there was a strict rule that U-boat commanders had to be at least 25 years old. By the end of the war the average age of a U-boat commander was 20. But wherever they came from and whatever their age, they were all brave young men and by the time they were sent to join their first U-boats they were ready to face battle-hardened Allied sailors often twice their age. Towards the close of the war, many went to sea knowing they had little hope of ever returning home.

Kriegsmarine
Denke im Gebete
an unseren liebsten Sohn und Bruder
Jakob Schmutzer
aus Guglöd
Obergefreiter bei der Kriegsmarine
welcher am 9. August 1943 im Westatlantik von der Feindfahrt nicht mehr zurückkehrte. Er erreichte ein Alter von 20 Jahren und 1 Monat
Den Opfertod bin ich gestorben,
Den Ehrentod fürs Vaterland,
Hab mir den Lorbeerkranz erworben,
Den mir ums Haupt ein Engel wand.
BUCHDRUCKEREI OTTO MORSAK, GRAFENAU

RIGHT Parents of U-boat crews lost in action often produced special memorial cards announcing the death of their sons to send to relations and friends. This card is for Private First Class Jacob Schmutzer, who was aged 20 years and one month and from Guglöd, a village near the Bavarian forest and the German/Czech frontier. Jacob joined the Kriegsmarine at the age of 16 in 1939 and served in Type VIIC boat U-359, which was sunk with all hands near Santo Domingo, Haiti, by depth charges dropped from an American naval Mariner aircraft on 26 July 1943. His memorial card, however, lists his date of death as 8 August. This discrepancy is due to the actual date that the U-boat was sunk and when reported missing. The inscription at the bottom reads:

My sacrificial death
Which honours death in Waterland
Gives me the laurel wreath
Which an angel has wound around my head.

FAR LEFT 'On patrol' – a pen and ink sketch by an unknown German artist.

LEFT 'Wolfgang Willrich (1897–1948) was a war artist assigned to various Nazi propaganda units. In 1939 he spent some time on a U-boat drawing portraits of crew members. **This is a picture of an unnamed leading engineer officer on an unknown U-boat.** *(German National Library – Willrich Collection)*

Every man on a U-boat had his own job to perform. These were the main players:

- **Kommandant** (commanding officer, captain): The usual rank for a U-boat commander was *Oberleutnant zur See*, *Kapitänleutnant* or *Korvettenkapitän*. He was the only man ever addressed directly as '*Kapitän*' and always referred to in the third person as '*Kommandant*'. He routinely made life-or-death decisions affecting the fate of his men. Crew members identified closely with commanders and were especially proud if he had been awarded a medal – they felt that they, too, had shared in his glory. The commander had ultimate responsibility for the entire U-boat just as the captain of any vessel would.
- **Erste Wachoffizier** (first watch officer, executive officer, first watch): Second in command and also known as 'Number One', he closely shadowed the commander and took over if the CO fell ill or was killed in battle. His other responsibilities included overseeing the submarine's first bridge watch, the boat's weapon firing systems and conducting torpedo aiming during surface attacks.
- **Zweiter Wachoffizier** (second watch officer): Responsible for the second bridge watch crew on deck and all flak and deck guns. He also oversaw radio and listening room crews.
- **Dritte Wachoffizier** (third watch officer, chief navigator and third watch): In charge of helmsmen and navigational duties.
- **Leitender Ingenieur** (chief engineer): A highly experienced officer responsible for the maintenance of the U-boat's mechanics, including engines, motors, batteries and other mechanical systems. He also set the demolition charges if the boat ever had to be scuttled, meaning that many chief engineers went down with their boats. He was also responsible for overseeing the provisioning of supplies for every mission.
- **Obersteuermann** (navigator boatswain).
- **Oberbootsmaat** (fourth watch officer).
- **Diesel Obermaschinist** (diesel engine officer).
- **Electro Obermaschinist** (electric engine officer).

Torpedo and artillery mechanics:

- **Mecanikaermaat** (torpedoman's mate) and **Mechaniker** (torpedo mechanic) – both responsible for care and maintenance of torpedoes.

- **Maschinisten** (machinist, motormen) and **Obermaschinist** (warrant machinist) – both responsible for making sure engines ran smoothly and efficiently.
- **Funk-Personal** (radio room personnel) – responsible for communications and sound equipment:
- **Oberfunkmeister** (senior radio petty officer).
- **Funkmaat** (radio petty officer).
- **Funkgast** (radio operator).
- **Obersteuermann** (chief quartermaster) – responsible for crew supervision and discipline.

Matrosen (seamen):

- **Seemnnisches Personal** (nautical personnel).
- **Technisches Personal** (technical personnel).
- **Zentrale-Personal** (control room personnel).
- **Artilleriemechaniker-Personal** (gunnery mechanical personnel).
- **Koch/'Smutje'** (the cook).

BELOW Brest, August 1941, letters from home – the first mail from family and friends for many weeks is distributed to U-boat crews returning from a war cruise. *(Jonathan Falconer collection)*

Crew quarters and conditions

'The heat. The stench of oil. Lead in my skull from the engine fumes. I feel like Jonah inside some huge shellfish whose vulnerable parts are sheathed in armour' – Lothar-Günther Buchheim, who served on board Type VII submarine U-96 as a war correspondent in 1941.

A Type VII U-boat was similar to a steel cigar tube crammed full of machinery and weapons of war. Anything not made from iron or steel looked out of place on the vessel. There were no compartments as would be found on a conventional surface vessel. Even the usual divisions between the engine room, the hold and the crew's quarters were absent. A U-boat interior was similar to a London Underground train with an aisle down the centre and open areas leading from it either side.

Every section of the vessel had traffic passing through at all times of the day and night. Everyone coming off or going on guard duty had to squeeze past the officers' mess table, which was secured to the floor and protruded into the aisle. Padded benches used at mealtimes by the officers were part of someone's bunk, serving double duty during the day. All official paperwork was done on top of the selfsame mess table, including coding and decoding radio signals. The commander's 'stateroom' was no more than a narrow recess separated from the rest of the boat by a green curtain – the sort normally seen in hospitals. This niche also served as his office and was where he wrote his log and private papers.

There was just one operational toilet on Type VII boats for up to 52 crewmen, which was located at the fore end of the boat. A second aft toilet did exist, its bulkhead leading straight into the galley, but it was removed from service and crammed with provisions to allow the boat to operate longer at sea. The only available toilet could not be used when the boat was submerged at more than 80ft. Men serving on a submarine for the first time found that answering the call of nature and simply flushing the toilet could prove as difficult as handling the rest of the submarine's intricate equipment (see pages 132–133, Much ado about flushing).

For many young Kriegsmarine submarine volunteers, conditions in their boat were often a nightmare – but they somehow learned to live in these hot, uncomfortable, claustrophobic and unsanitary conditions, deafened by engine noise and inhaling the constant stench of oil, diesel and the body odour of their fellow crew members. No fewer than 40,000 other men serving in Germany's U-boat fleet felt the same. On dry land, the German public reading newspapers and magazines, listening to the radio and going to the cinema had a very different impression of life on a U-boat out on active service. To them the life of a Kriegsmarine submariner was one of heroics, glamour, high adventure and daring deeds, glorified in dispatches sent back by men like Lothar-Günther Buchheim, a propaganda officer writing as a war correspondent about his U-boat experiences. There was no mention in the media of what life was really like in a place where engines and batteries filled a third of the working and living area and where the crew were forced to share their own space with over 200 tons of fuel, 14 torpedoes, ballast tanks, navigation and signalling equipment, ammunition for deck guns and over 20 tons of food and drink.

Type VII boats had separate berthing for crew members according to their rank. Petty officers were berthed in eight bunks – four portside and a further four starboard – forward of the galley and aft of the control room. The captain's tiny private area contained his bunk, a small table, a cupboard with a few drawers and a powerful short wave radio for his own personal use. The forward torpedo room had bunks for a further seven men. Extra sleeping accommodation came in the form of mattresses spread over the floor or hammocks slung from pipes or anything else strong enough to hold the weight of a slumbering submariner.

Radio and listening rooms were located on the starboard side, adjacent to the commander's berth. Adjoining and open to it, was the wardroom consisting of a small, fixed wooden table and slide-around bench. A non-watertight bulkhead separated the wardroom from the warrant officers' berthing, beneath which the forward batteries were located directly beneath a set of four starboard bunks.

Submariners occupied what little space was left around the torpedo stowage area in the

LEFT U-boat ace *Kapitänleutnant* Joachim Schepke of Type VIIB boat U-100 was every inch the perfect Aryan ideal and was christened 'the best-looking man in the U-boat-Waffe'. He is pictured showing a young admirer a model of a U-boat. Schepke died at the age of 29. After five patrols, U-100 was attacking a mid-Atlantic convoy on 17 March 1941 when it was severely damaged by depth charges. Forced to surface, the U-boat was rammed by escort destroyers. Schepke was on the conning tower and was crushed by the periscope standards. During his life, he was one of the stars of submarine service and was extolled as an example for German youth to follow. *(Karl Parlour)*

LEFT An off-duty game of skat while sitting on bunks and using a mess table aboard a Type VII U-boat. Skat was – and remains – one of the most popular card games in Germany. Note the crewmen in the over-slung hammocks.

forward torpedo room. Until the first torpedo had been fired and a reload hoisted into position in the empty tube, there was no room for men to stand or sit, owing to a set of spare torpedoes stowed at deck level with crew accommodated on a temporary wooden deck built on top of them. Like the rest of the boat, this space was also cluttered with crates and sacks of food while overhead swung hammocks stuffed to bursting with more provisions and supplies.

On the port aft side of the torpedo room was the boat's single usable toilet. The second toilet was routinely taken out of service and turned into a pantry full of tinned vegetables, fruit and soup. This left the whole crew of over 40 men competing for a single toilet and if two urgently needed to use it at the same time, one of them had to either wait or use a bucket. Once inside the toilet, its user had to flick on a switch which illuminated a blue light outside the door indicating it was occupied. Whenever the blue light was switched off, there was always a scramble of men rushing towards it from both directions of the passageway. The toilet's flush system consisted of a hand pump, from which toilet waste was expelled into the ocean after each use. Using the toilet was prohibited when stalking the enemy as the noise of clanking metal or floating debris could alert the enemy to the presence of a submerged U-boat (see pages 132–133, Much ado about flushing).

When the boat descended below 80ft, the single toilet was taken out of use because pumps used to flush the facility could not function against the water pressure outside the hull. When this occurred, men who needed to answer the call of nature used either a bucket or an enamel bowl.

Bunks were a luxury unknown to occupants of the torpedo room. These young enlisted submariners either slept on the deck floor in empty packing crates used to bring food on board or – if they were lucky – in hammocks. Any available bunks were squeezed in between machinery, an arsenal of torpedoes, loading carriages or other U-boat equipment. Around half of the boat's crew shared living space on bunks in the bow room, a tapering section only 12ft across at its widest point, where they not only slept but ate their food and spent any off duty time they might have enjoyed.

On either side of the central passageway were built-in bunks all measuring the same – 180cm long by 58cm wide – each with a thin foam mattress on top. On either side of the passage there was a green table with folding leaves which could be dropped to the left or right to allow crew to squeeze past. A compressed air hatch separated the petty officers' quarters from the control room. All around the bulkhead, sausages and smoked meat dangled alongside leather gear and oilskins, making the area look like displays in a slovenly butcher's window. Thick bundles of cables and pipes ran along the length of the ceiling and every inch of available pipe was used to hang something from.

Buchheim recorded his first impression of the boat as being like entering a deep-sea fish. He said that the submarine did not provide the crew 'with anything like a home'. Geared exclusively to warfare, it allowed men just enough space to sleep or perform essential chores. Sausages dangling from the ceiling – even in the control room – were 'grotesque fairground symbols of the human condition, hopelessly lost in this battle-engine'.

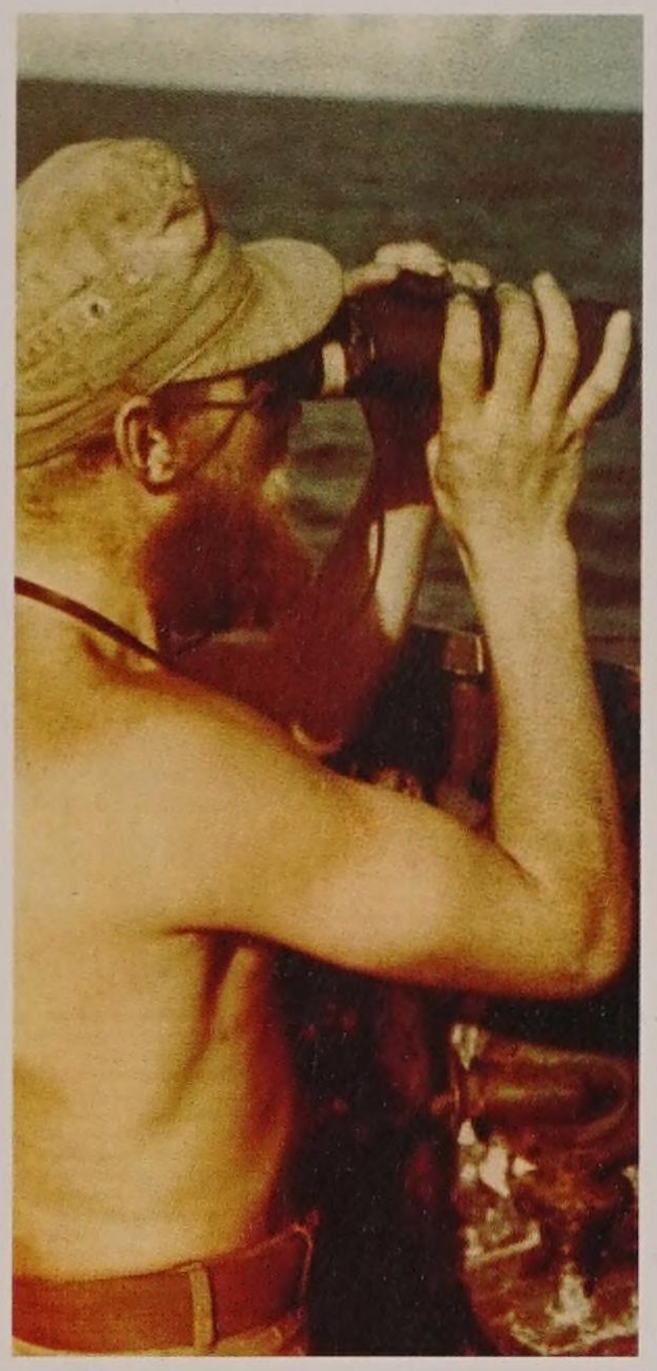
Each occupant (or occupants, as bunks were given over by men coming on watch to others coming off watch) was assigned two small wooden lockers next to their bunk. Lockers measured 40cm wide by 26cm high and were around 9cm deep – big enough for personal possessions such as books, writing materials and family photographs. At 60cm tall and 38cm wide, larger wooden lockers offered just enough room for waterproof clothing, boots and a towel.

No other vessel of war presented worse living conditions than a U-boat. Each war patrol could take anywhere between two weeks to six months to complete and, during that time, crews were not permitted to bathe, shave or change their clothes. Men were issued with black underwear, which they claimed had been dyed that colour because it would not look dirty even when unlaundered for weeks or months on end.

U-boats were made up of specialists and ordinary seamen. Specialists such as radiomen, torpedomen or machinemen were responsible for the operation and maintenance of equipment aboard their boat. Other general duties such as loading torpedoes, standing watch on the

RIGHT The Kriegsmarine booklet *As I come to the Kriegsmarine* made deck patrols on U-boats look like fun, with watch crews wearing tropical hats enjoying the sunshine with their shirts off while on duty. But the truth was very different. Deck patrols were a great strain on the eyesight of watch crews as they peered through binoculars into bright sunshine or darkness, searching the horizon for enemy ships or aircraft. Crew had to stand for many hours at a time in all weather conditions throughout the day and night.

ABOVE A petty officer takes a sun-sight on the bridge of an unidentified U-boat. The circular block in the foreground is a base used for torpedo-aiming apparatus and the two saucer shapes on the rim of the bridge are the engine room telegraph repeater (left) and magnetic steering compass. *(Triangle)*



RIGHT Deck patrol on Type VIIC boat U-552. Between 1940 and 1941, the boat was commanded by *Kapitänleutnant* Erich Topp, one of the Kriegsmarine's leading U-boat aces. It was important that sharp lookouts were posted on the bridge while operating on the surface. Maintaining a vigilant lookout was tiresome and crews on watch duty were regularly moved around the bridge before being relieved by the next shift. Four lookouts were posted and each systematically positioned to scan a different 90° sector around the boat. The horizon was scanned for ships or distant smoke, indicating an approaching vessel. The sea surface was also carefully scanned for periscopes and the skies above for enemy aircraft. Under no circumstances were lookouts allowed to deviate from their duty. *(Acme Newspictures, Inc., New York)*

RIGHT The WC in U-995 was twice as complicated to flush as half of the flushing device was located around the toilet pedestal while the other half was on the wall next to the WC itself. It came complete with a handle that had to be carefully manoeuvred backwards and forwards to release waste into a series of chambers and an airlock which expelled it into the sea.

BELOW LEFT Using a toilet has never been more complicated than it was aboard a U-boat. Strict instructions on how to flush the complex high-pressure WC were pasted on to the toilet wall. It tells users: 'Important! Read before using! Service instructions.' It then informs users 'what to do after using the closet'. This involved a sequence of complicated manoeuvres, pulling and pushing levers and turning handles to open and close valves. Some U-boats had a warden available to help nervous users to flush the toilet. The warden could also do the job for you, because making a mistake could flood the WC, meaning that the contents of the toilet could 'come back at you'.

MUCH ADO ABOUT FLUSHING

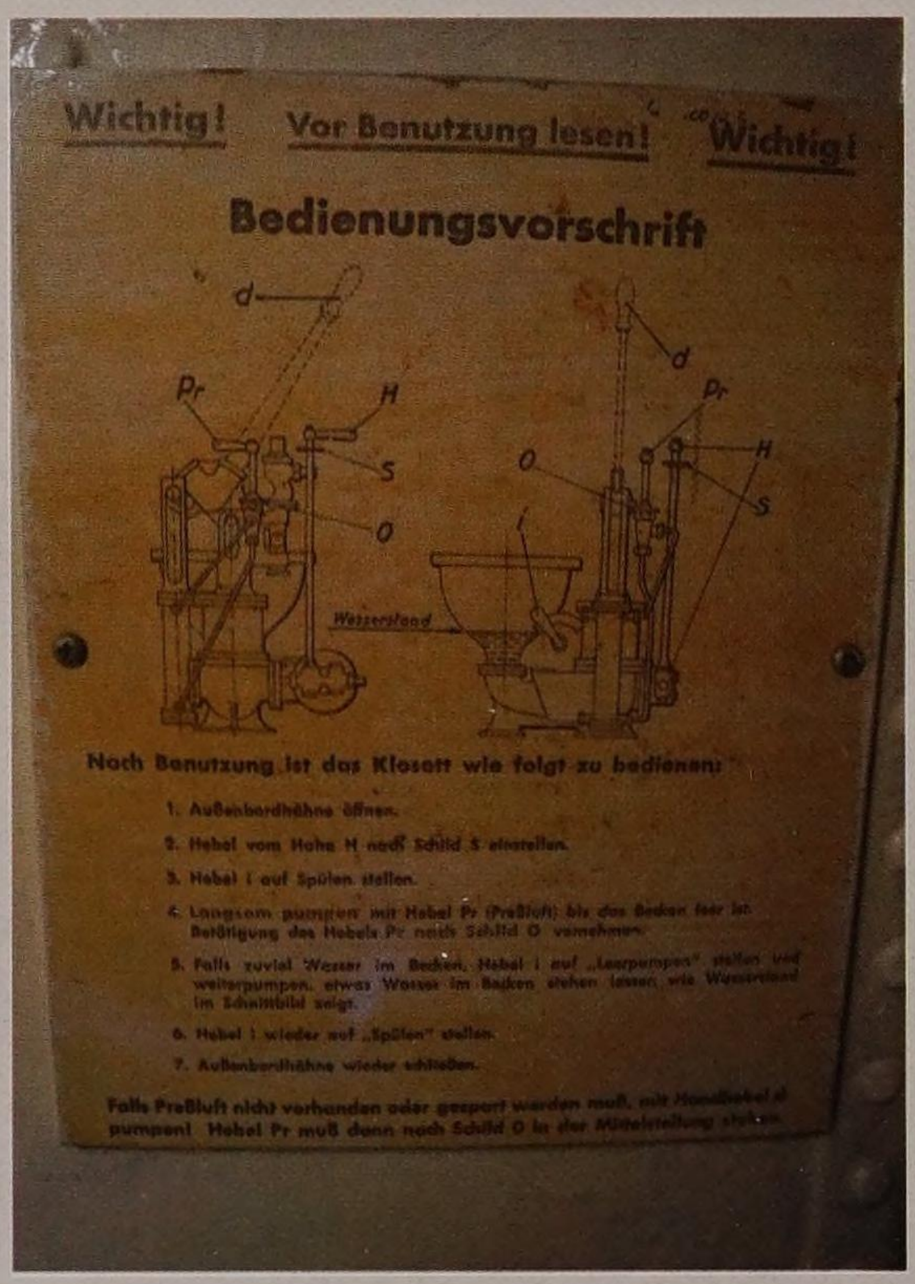
The proper name given to a WC on a Kriegsmarine surface ship or a U-boat was (and still is) *Der Staats* – or 'the heads'. On a Type VII boat there were two *Staats* – but one was taken out of service and used as an extra food larder. Using the only fully operational WC throughout a long patrol, therefore, required the U-boat crew to have determination, patience and a sharp eye. Swiftness of foot in order to reach it before anyone else also helped.

With over 40 men on board and just one toilet for all of them, *Das Donnerboxen* ('the thunderbox') as it was affectionately known, was continually in use 24/7. Dozens of pairs of eyes were fixed on the blue 'engaged' light above the door in anticipation of it being switched off, indicating it was free for the next user. But there was never one single user waiting to use the facility – there were dozens. As soon as the light went out, there was a scramble both ways down the narrow gangway of men falling over each other to be next.

Once inside the WC, crew members faced another challenge of the kind they would never encounter on dry land or on a surface ship – a fiendishly complex piece of equipment known as a *Hochdruck-wc* or 'high-pressure toilet'. While this marvel could be flushed while the U-boat was underwater, to do so required a complex series of levers and valves to be opened and closed in exactly the right order.

So important was it that users flushed the toilet correctly that detailed instructions had been pasted to the wall providing a step-by-step guide on what pump to push and what lever to pull. Instructions told toilet users: 'Important! Read before using! Service instructions.' They were also informed that if the instructions were not followed to the letter, the

BELOW WC users needed to 'read before using' and follow instructions carefully.


Wichtig!
Vor Benutzung lesen!
Wichtig!
Bedienungsvorschrift
Pr
H
S
O
Wasserstand
Nach Benutzung ist das Klosett wie folgt zu bedienen:
1. Außenbordhähne öffnen.
2. Hebel vom Hahn H nach Schild S einstellen.
3. Hebel I auf Spülen stellen.
4. Langsam pumpen mit Hebel Pr (Preßluft) bis das Becken leer ist. Betätigung des Hebels Pr meldet Schild O vornehmen.
5. Falls zuviel Wasser im Becken, Hebel I auf „Leerpumpen" stellen und weiterpumpen, etwas Wasser im Becken stehen lassen, wie Wasserstand im Schaubild zeigt.
6. Hebel I wieder auf „Spülen" stellen.
7. Außenbordhähne wieder schließen.

contents of the toilet would be back-siphoned over the user. This was known to submarine crews as 'getting your own back'.

So complicated was the high-pressure toilet that not only did it come with the instructions on the wall but also its own dedicated 'warden' charged with making sure it was flushed correctly each and every time for any crewman unsure of how to go about the task. The warden had been given special training to instruct fellow crew members on how to safely flush bodily waste away into the sea – or flush it for them if they preferred. On the U-boat he was known as '*Der König der Staats*' – or 'the king of the heads'.

Those brave enough to flush it themselves were told to reach for lever S, push it back and then pull it forward. They then had to look for hand lever 'D' and pull it upwards, turn it to the right and then back to the upright position. If this was done correctly, a jet of compressed air would shoot into the toilet to clear the waste. If incorrectly performed, a terrible mess would flood the WC – and the last person to use it.

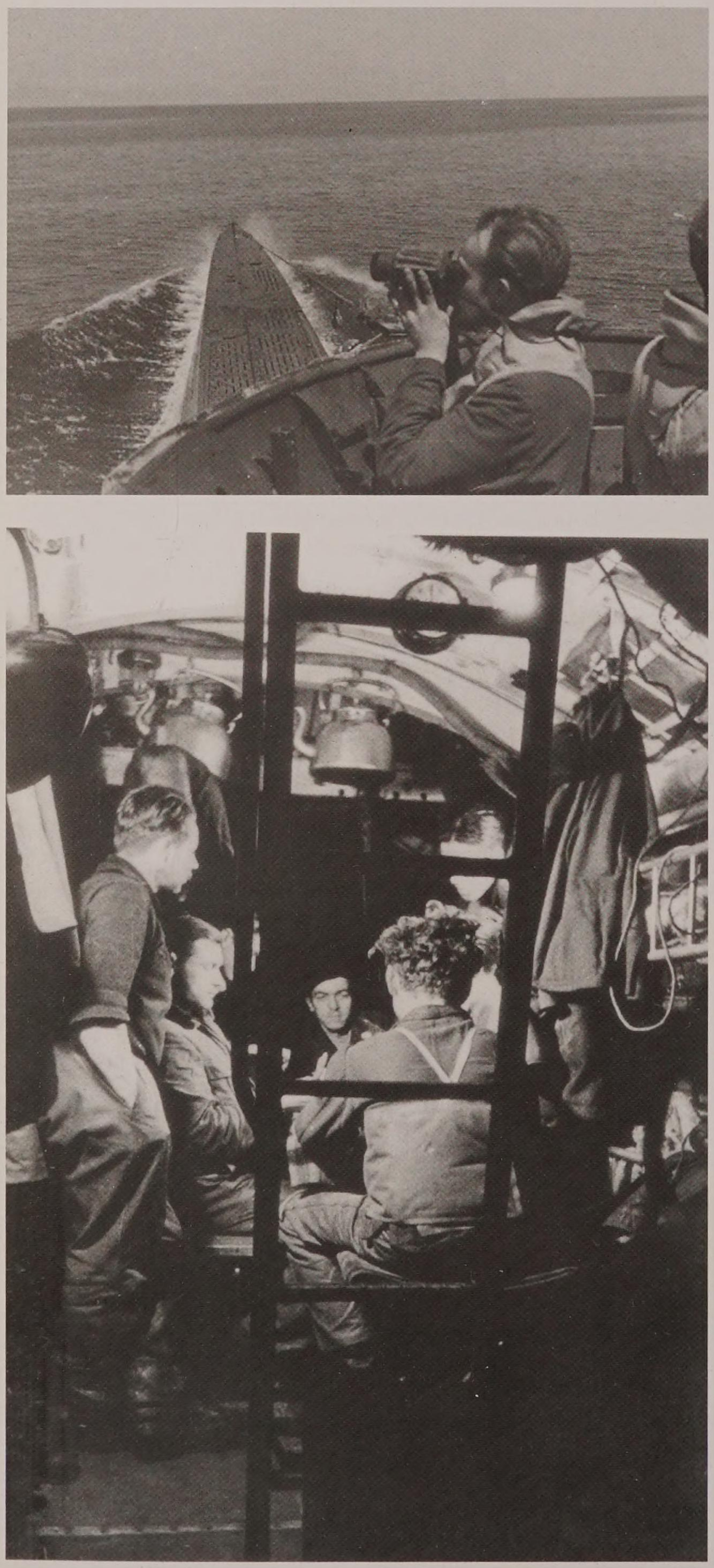
Using the toilet was prohibited when stalking an enemy underwater as it was feared that the noise of clanking metal from the WC or discharged floating debris would alert the enemy to the presence of a U-boat. In that event, buckets and basins were used, later emptied into the WC when safe to do so, or thrown over the side once the submarine had surfaced.

If the U-boat was travelling through 'safe water' – meaning there were no enemy ships or aircraft in the vicinity – and the weather was fine, it was possible for crew to go up to the deck to use an 'outside toilet'. To do this, men had to climb on to the guard rail and settle themselves on to a small metal seat to perform their toilet function while hanging on to a safety rope. It was not the most popular way of going to the toilet, but then again, neither was using the WC down below. But, when nature calls . . .

U-1206 was a Type VIIC boat fitted with a new deep-water high-pressure toilet allowing the WC to be used while running at depth. As usual, flushing the toilet was challenging and special technicians were trained to operate it for those unsure how to do so. In April 1945, 13km off Peterhead, Scotland, and while cruising at a depth of 61m, misuse of the toilet caused large amounts of water to flood the boat. According to the commander's official report, while in the engine room helping to repair one of the diesel engines, he was informed that a malfunction involving the toilet had caused a leak in the forward section. The leak flooded the submarine's batteries – located underneath the toilet – causing them to release chlorine gas and forcing him to bring his boat to the surface. In no time U-1206 was discovered and bombed by British patrols, forcing the commander to scuttle the submarine. One man died in the attack, three men drowned in the heavy seas after abandoning the vessel and forty-six were captured.

LEFT U-boat crew members were reminded to wash their hands after using the WC – but they had to use cold water from a tap releasing seawater.

BELOW If all else failed, or the WC was engaged with a long line of men waiting to use it, a quick trip on to the main deck solved the problem. *(Through Their Eyes)*



LEFT Binoculars used by many submarine officers were made for the U-boat-Waffe by Carl Zeiss of Munich. They were considered the best ever produced by the company. The binoculars were waterproof and came with internal focus adjustment dials and foldable eye cups on hinges, allowing the lenses to be cleaned easily. The cast-iron apparatus was painted olive green. They offered field views of 9.1° and weighed 2.6kg. Today a pair of these binoculars can fetch prices of over £2,000. *(Through Their Eyes)*

bridge and operating deck guns were performed by trained seamen. Their workload was divided into shifts, with crew working in three eight-hour shifts – one for sleeping, one for regular duties and one for miscellaneous tasks. Specialist crew, such as the radiomen, had three four-hour shifts between 08.00 and 20.00, and two six-hour shifts during night hours.

Standing on watch duty in dark and stormy weather was never popular with crewmen. The harsh North Atlantic environment meant that icy waves constantly swept over the bridge, often submerging the boat and its crew for brief periods. The four crew working on the bridge were issued with special foul-weather coats, but these did little to keep them dry during a stormy night patrol. In extremely rough weather, night watch crews were secured by safety lines to keep them from being washed overboard. To help them see better at night, crews were issued with special 'vision pills' which, when swallowed an hour before going on watch, dilated their pupils to enhance their vision. The effect, however, wore off after three or four hours. Night watch crews also had access to infra-red night-vision goggles, which they wore inside the submarine for 15 minutes before climbing up the ladder to the bridge. Once in position they would remove the goggles and their eyes would be adjusted to night-time vision. They would then reach for a pair of high-grade binoculars before being allocated a sector to watch. Watch positions were changed regularly.

Prior to night surfacing and while on the

LEFT While off duty members of the crew find time to relax and play cards in their cramped and crowded quarters.

surface, the conning tower and control room was lit with low red lights. More remote parts of the boat, far removed from bridge activity, remained lit by low-powered white lights.

Personal comfort ranked low on the Kriegsmarine's priority list for U-boat crews. Fresh water was limited and strictly rationed for drinking, especially after some commanders exchanged storage of drinking water with diesel fuel in storage tanks to extend their operational range. At the start of a patrol, crew were only permitted to bring on board the clothes on their backs, the boots on their feet and a change of socks. To remove salt from their skin caused by seawater exposure, they were issued with special saltwater soap, but this proved unpopular as it left a scummy film on their skin. To control – or attempt to mask – body odour, a deodorant called Colibri was issued to the men. It didn't smell particularly nice but it helped cover the collective stink of dozens of sweating men.

Long war patrols took a psychological toll on many crews. Weeks and often months could pass without sight of trees, hills or a place where seamen could place their feet on dry land. Except for the excitement raised when hunting an enemy ship, or the adrenalin rush when being hunted themselves, crews passed the time by listening to music on a record player built into the boat, playing cards, reading or organising games to keep minds occupied.

Time to eat

There was no conventional crew mess on board Type VII U-boats. Instead of sitting around a single communal table to eat meals, enlisted men ate their rations wherever they could find a convenient space – often placing a plate across their knees while perching on the edge of a bunk, on top of a work surface, shelf, a fold-down table – or even balanced on top of torpedo tubes. Officers and NCOs sat around their own mess table and were always first to be served.

Crew members dined four times daily, apart from when action was taking place above or below the waves, in which case food was prepared and consumed under battle conditions. Food was also included as part of

ABOVE A freshly prepared hot meal is taken in March 1944 in the claustrophobic quarters of a U-boat's forward torpedo compartment. *(Jonathan Falconer collection)*

LEFT A provisions hatchway, located directly above the galley, was used for loading fresh and tinned food and drink at the start of a patrol or when provisioning at sea.

LEFT A '*Smutje*' supervising the loading of provisions prior to a submarine's departure on war patrol. *(Triangle)*

an enlisted crew member's weekly pay and a small mess allowance was deducted from the pay packets of all ranks on active duty.

Submarine crews always received plentiful supplies of meat, potatoes, bread and vegetables with fresh fruit at the start of each voyage and vitamin supplements for the remainder. Most crew lucky enough to live through the war – apart from those sent to prisoner of war camps – went home at least 9lb heavier than when they joined the Kriegsmarine. Sailors also enjoyed the privilege of collecting a special food parcel – known as the *Führerpakete* (Führer's package) – containing flour, butter, sugar, coffee and sausage – which they took home on leave to share with their families, all with the compliments of Adolf Hitler. Good food in quantity, therefore, provided tangible proof of a U-boat crewman's 'special' status.

Three rules governed the storage of rations on U-boats. They had to be securely stored so as not to come loose during enemy attack; they had to be distributed so that consumption did not disturb the boat's trim; and rations had to ensure free access to all hatches and valves. As food was consumed, its weight was recorded along with any other consumables expended, in the *Leitender Ingenieur* (chief engineer's) daily weight report.

At the start of a mission, as much food as possible was crammed into every nook and cranny available on board. Pre-cooked smoked hams, liver sausage and other cured meats were hung from pipes and cables running along the inside roof area providing an interesting aroma for those sleeping on top bunks just inches away from rations. One seaman wrote in his diary that the hams and sausage 'swayed like edible stalactites in a steel cave' above his bunk.

Menus prepared by the boat's '*Smutje*' (or 'Smut' – the name given to every U-boat cook) were followed strictly to promote correct diet and nutrition. According to a report produced by British Naval Intelligence following the capture of Type VIIC boat U-70 south of Iceland: 'Food conditions on the submarines seem on the whole to be exceedingly good and of the very best. Fresh fruit was liberally supplied to the crew.'

A 42-day meal plan for the crew of U-70 shows that breakfast usually consisted of coffee, cocoa or soup, jam, butter or honey and eggs. Lunch might be soup, potatoes, cooked meat, macaroni, vegetables and fruit. Dinner included sausages, tinned fish, cheese, bread, pickles, coffee, tea or chocolate. Various meals and snacks were also prepared during the night for men on duty during the night watch.

When rations ran low, long-lasting tins of *sauerkraut* – finely cut cabbage fermented by lactic acid bacteria – were opened. Most submarine personnel would have been brought up eating this dish, but after weeks at sea, eating *sauerkraut* on board meant that many never wanted to eat it again once back on dry land.

A popular dinner dish regularly produced by the cook was a rich, thick hotpot called '*Eintopf*', dished out from a lidded, stainless-steel urn – known as a '*langesboot*' (long-boat) – to hungry submariners. Cutlery was handed out as meals were served.

The *Smutje*'s tiny galley was tucked away on the starboard side, between a food storage area, aft of the CPO's quarters and forward of the diesel engine room. It comprised a 110/170V stove, two 3kW and one 1kW hotplates, a 4kW oven and a 10-litre boiler. The stove measured 91cm wide and 35cm deep. The galley included a small refrigerator, a self-

RIGHT A young cook or '*Smutje*' in the tiny galley of Type VIIC boat U-373 prepares a meal for hungry crewmates. *(Karl Parlour)*

CHRISTMAS ON PATROL

ABOVE Christmas celebrations away from home onboard a U-boat, including a Christmas tree, decorations and a white table cloth. U-boat crewmen did not normally wear uniforms when inside their boats during war patrols, but note how many sailors have dressed for the occasion and wear a mixture of standard blue service dress and tropical uniforms for their special Christmas lunch. *(Through Their Eyes)*

BELOW In this picture the '*Smutje*' appears to have done his best for a crew unable to make it home for Christmas. On the table are freshly made stollen and apfelstrudel, all washed down with freshly brewed coffee.

BELOW The crewman (top left) provides musical entertainment with his piano accordion (he would have needed the captain's permission to bring it on board). Note the improvised Christmas tree in front of the Kriegsmarine flag.

heating soup kettle, provisions lockers and an enamel sink with taps for hot and cold fresh water and hot salt water. A large wooden board fitted over the sink acted as an extra surface for food preparation and a serving area. It measured 84cm long by 45cm wide. Food storage and distribution of supplies to the cook was the responsibility of the *Obersteuermann* (navigator) who doubled as the boat's quartermaster. It was his job to ensure that food was stored as evenly as possible throughout the boat with non-perishables crammed into a small larder near the galley and the second toilet which had been taken out of commission. Bread originally purchased on dry land was stored in the forward torpedo and electric motor rooms. When fresh bread ran out early in the patrol, more was baked every day until stocks of flour and yeast ran out and no more could be made for some time after. After a few days, the bread would sprout mould, which crews promptly nicknamed '*kaninchen*' or 'rabbits' due to its fuzzy white appearance. Some fresh meat was stored in the small refrigerator and pantry, but other produce brought on board at the start of a mission had to be consumed quickly before it became mouldy and began to rot.

Smutjes were regarded as the most important men on board a submarine after the commander. They worked morning, noon and into the night to ensure meals were always ready when expected. If a mealtime was interrupted by enemy interaction, food preparation was slowed down, but *Smutjes* carried on cooking. Some *Smutjes* prepared meals while a battle was raging above, assuming that once the battle was over the crew would be hungry and ready to eat. They carried on working, too, once U-boats had crash-dived and while on the run from Allied ships tossing depth charges in their direction with a view to a kill.

Smutjes usually had some pre-war civilian training as a cook in a restaurant, hotel, café or patisserie before joining the Kriegsmarine. Others might have worked as bakers or butchers. Some commanders permitted *Smutjes* to prepare celebration food – when supplies allowed – on special days such as birthdays (including the Führer's), Easter and Christmas to help break up the monotonous dining routine. Cakes would be made using synthetic cream. Christmas stollen (a traditional German fruitcake) and hazelnut torte at Easter would be served, and for a while deep in their submarine, the crewmen's thoughts would turn to home where similar fare would be eaten by their parents, wives and girlfriends hundreds of miles away back on dry land.

Goodies such as fruit, chocolate, pastries and sweets were kept under lock and key until opportunities arose to reward the crew. Commanders insisted that treats be kept back and used for jobs well done – or withheld as a punishment for greediness or insubordination.

Once fresh supplies became exhausted, canned goods supplemented by a soy-based filler called '*Bratlingspulver*' came to the rescue, although it was unexciting and tasted bland. Issued especially for U-boat crews, the dish was referred to as '*diesel essen*' or 'diesel food' due to its constant exposure to the diesel exhaust that flooded the boat night and day.

To understand living and eating conditions in a Type VII boat, the following snippet from Harald Busch's *U-boats at War* is worth reading:

In the diminutive galley, the cook is preparing the supper. When the meal is ready, the duty stewards (mess cooks) will come staggering along the central gangway to fetch the meal for the seamen in the fore-ends and the petty officers aft of the control room, carrying in one hand the can for the coffee or ready-sweetened tea, and in the other the 'long-boat,' a deep, bucket-shaped container for the food. As the ship lurches in the seas, they will have an awkward time of it on their return trip, propping themselves against a bulkhead here with their elbows, leaning there, backs pressed against some other support, while the men along their route lend willing hands to see that the supper reaches its destination intact. Those that can't manage a job like this – well, it's just too bad, they're not suited to life in a U-boat and before long they'll be posted ashore.

While stewards wait at the galley, the mess traps are brought out from the cupboard and the racks – called 'Fiddles' – and are secured to the table to prevent dishes sliding off with the movement of the boat. In the petty officers' mess, too, a hum of voices has started up in anticipation of the meal.

RIGHT A tiny basin in U-995's galley was used for cleaning food and washing dishes. When a wooden board was placed over the basin it doubled as a food preparation area.

A hot, grease-smeared face pops out of the galley and before starting to dish out, the cook issues a preparatory warning, 'Fried eggs, three each!' Then he starts counting them out into the containers. After the eggs come the gherkins, then a steward from the seamen's mess – known as 'The Emissary of the People' – goes staggering forward again, through the throng in the petty officers' mess, through the control room, through another hoop, past the commander, who sits reading on his bunk, through the ward room and the warrant officers' mess and so to the seamen's mess close to the bow.

For the petty officers, arrangements are more genteel. They have their eggs served straight onto their eating boards, gherkins are put on a separate plate, butter in a metal dish, and they are issued thick slices of bacon and sausage, as well. There is tea, with or without lemon juice, and bread is slung in hammocks above the mess table where everyone can help himself.

Men in the seamen's mess usually eat with their bare hands, simply lifting the eggs out of the long-boat and stuffing them down, or else eating them on a piece of bread. As to washing their hands afterward – 'What?' they'd say. 'In the middle of eating your supper? Far too much trouble. Once a day is enough, in that oil-filmed water you get from the tank.'

Although crew were forbidden to bring alcohol on to their boat, they were sometimes grateful to their commander for being permitted to take an occasional swig from his private supply on special occasions, such as when an enemy vessel had been sunk, someone's birthday or when somebody got especially soaked while working on the bridge.

RIGHT Life below the waves – the officers' mess on U-373 offers little more than the crew's mess in the way of creature comforts.

Chapter Six

Type VII in action

Type VII U-boats enjoyed spectacular victories throughout the war – the sinking of the liner SS *Athenia* and the aircraft carrier HMS *Courageous* showed how vulnerable unescorted ships were against German U-boats. When U-47 sank the battleship HMS *Royal Oak* in October 1939 inside Scapa Flow it forced the Home Fleet to move to temporary anchorages around the Scottish coast. In the Battle of the Atlantic German U-boats sank thousands of tons of Allied merchant shipping and took Britain to the brink of disaster. The U-boat was a game-changer.

OPPOSITE A fatally wounded Allied merchant ship is helped on its way to the bottom by the deck gun of a German U-boat. *(Bundesarchiv)*

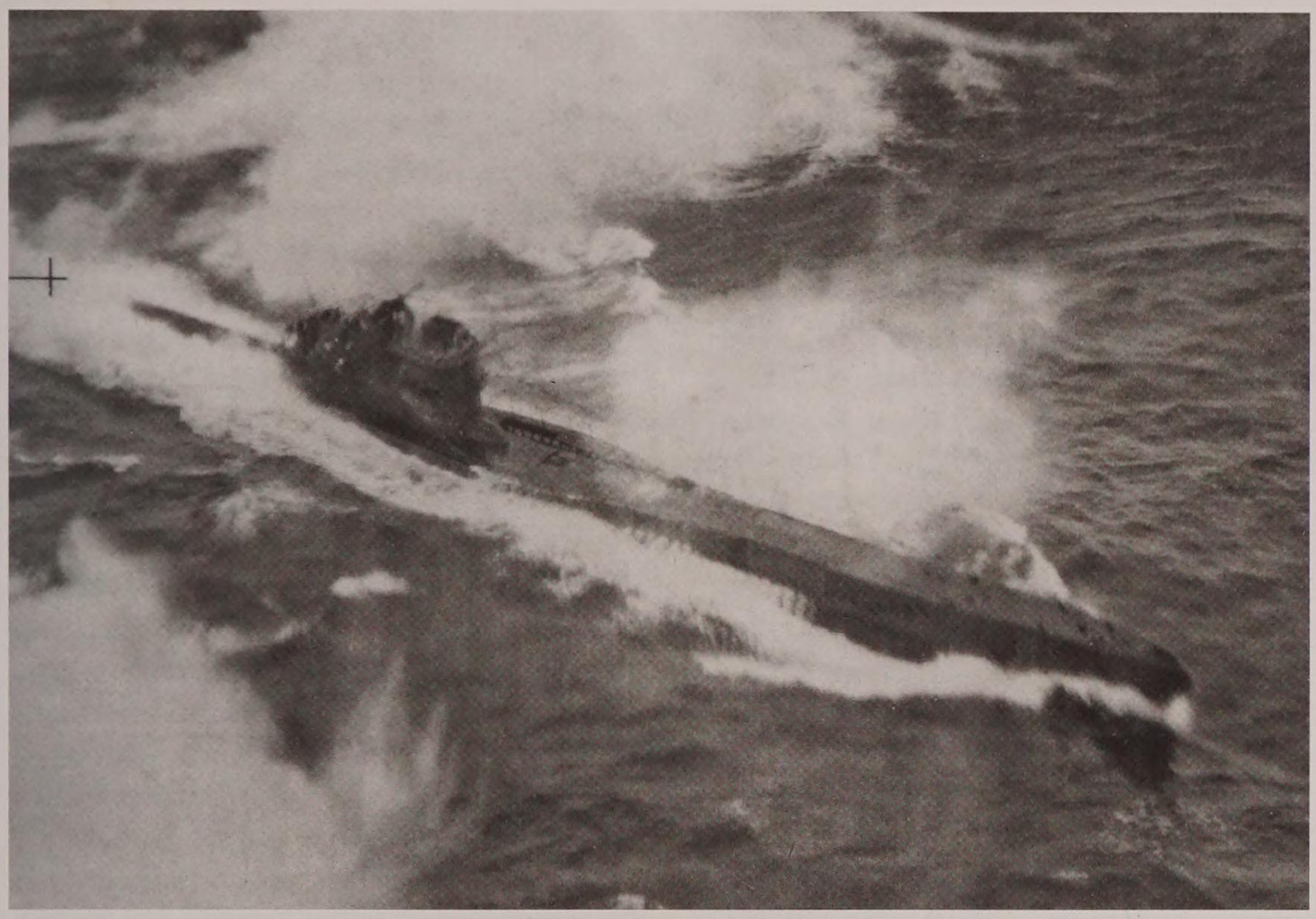
Surprise attack!

U-boat commanders had to exercise high degrees of surprise to successfully attack their enemy and then withdraw undetected. To achieve this, U-boats had to remain unseen day and night.

At U-boat training academies, commanders learned that: 'He who sees first, wins!' It was important that sharp lookouts were posted on the bridge when operating on the surface. Maintaining a vigilant lookout was tiresome and crews on watch duty were regularly moved around the bridge before being relieved by the next shift. Four lookouts were posted and each was systematically organised to scan a different 90° sector around the boat. The horizon was scanned for ships or distant smoke, indicating an approaching vessel. The sea surface was also carefully scanned for periscopes and the skies above for enemy aircraft. Under no circumstances were lookouts allowed to deviate from their duty. Even during a deck-gun engagement, lookouts were forbidden to witness battle progress for fear that the U-boat might be surprised by an enemy vessel. Particular attention was paid to the sun sector, as visibility was always impaired when lookouts surveyed areas looking directly into the sun.

When cruising on the surface the periscope did not need to be raised, but when diving down to 'periscope depth' – around 9m – it was raised once the boat was completely submerged. The periscope was lowered before breaking the surface and often, after resurfacing in clear weather, a lookout armed with binoculars was hoisted up a raised periscope to get a better all-round view. This, however, presented two dangers: it took longer to crash-dive when the lookout spotted an enemy aircraft and a U-boat with a raised periscope was easier to detect. Commanders believed that in clear weather, it was better to submerge too early than too late. U-boats needed to crash-dive as soon as the funnel top of an enemy ship was sighted on the horizon. Surface ships often placed lookouts on top of their masts equipped with binoculars and rangefinders with powerful

BELOW Type XXI electro-boat, U-2502, comes under cannon fire from a Mosquito FB VI during an attack on four surfaced U-boats and an M-class minesweeper escort south of Göteborg in the Kattegat on 19 April 1945. U-2502 received only slight damage. *(IWM C5338)*



LEFT An unidentified Type VIIC comes under attack from depth charges dropped by an RAF Coastal Command aircraft. *(Jonathan Falconer collection)*

optics. In poor visibility it was preferable for U-boats to submerge, since their hydrophones were better at detecting ships much further away than any lookout could ever see.

When submerged and stalking the enemy, commanders raised their periscopes at 4,000–5,000m from the enemy. At closer distances, periscopes had to be used sparingly, exposing only the tip intermittently and while travelling at low speeds to create less wake. Before surfacing, an all-round sweep was performed at a depth safe from ramming (around 20m). The U-boat could then surface to periscope depth and another all-round periscope scan could be undertaken. If all was clear, the submarine then broke the surface at high speed. The commander undertook another all-round scan from the bridge and only when he was sure that all was safe he would order the ballast tanks to empty their water.

The best defence against air attacks was to spot them in time and crash-dive to safety. Unless otherwise confirmed, every aircraft sighted was treated as hostile. In clear weather, it was preferable to remain on the surface, keeping a vigilant lookout for enemy planes. Although the dangers of air attack were always present, it was often possible to spot enemy aircraft in plenty of time, instead of remaining submerged and losing an opportunity to attack. In low visibility, or on days with thick cloud cover, it was best to submerge to prevent attacks.

It was hard to detect U-boats from the air, and often it was the wake of the boat which was spotted first, rather than the boat itself – particularly if the boat was cruising at high speed. A U-boat was also difficult to spot when sailing on choppy waters and wavy seas, rather than on calm waters. Turbulent conditions, such as those in the Baltic, the Mediterranean or close to the mouths of rivers, presented better U-boat cover. Once submerged it was hard – but not impossible – to sight a U-boat. In clear weather when the sun pierced the water, on calm seas and with aircraft flying almost directly overhead, it was possible to discern a submerged U-boat at periscope depth. But without these ideal conditions, a submerged U-boat was relatively safe from aircraft detection.

Submerged attacks against warships and convoy vessels mostly took place in daylight. Once underwater, a U-boat was slow, hard to manoeuvre and almost blind. Enemy sonar and hydrophones could also detect submerged submarines. Owing to their slow underwater speed, U-boats needed to be ahead of convoys and in a favourable attack position. Remaining

concealed and undetected was important, as once a U-boat was located, escorts pursued it or convoys changed their course, leaving the U-boat far out of position.

Once ahead of a convoy, U-boats often dived deeper until escorts had passed overhead. Greater depth reduced the effectiveness of sonar and through its hydrophones, commanders could better locate the position of escort ships. To avoid detection, U-boats had to move slowly in order to keep engine noise low. This also conserved battery power. Once inside a convoy perimeter, submarines rose to periscope depth with observations made in short peeks and at low speeds. Moving slowly also caused less periscope wake. Where possible, the ideal direction of approach was with the sun towards its back, as glare made it harder for enemy lookouts to spot periscopes.

Once in position, the targeting procedure took place. The largest targets were selected first and a spread of torpedoes fired, with the weapons aimed at the furthest targets being launched first. From his position inside the conning tower, the commander was the only one who looked through the attack periscope and made targeting decisions. Once a torpedo was launched, the weight of the boat had to be immediately balanced with ballast as the launching of torpedoes resulted in more than a ton of positive buoyancy. If this was not offset by ballast, the boat might rise to the surface, immediately giving away its position. Many U-boats were caught and attacked owing to this simple error.

After the torpedo was launched, the crew timed the weapon's run using a stopwatch. They waited and listened for the sound of an explosion at its estimated impact time. If that did not happen, it usually meant the torpedo had missed its target or was making its way back to the U-boat, with fatal consequences.

Prepare to crash-dive

Every U-boat crew member knew that when it was time to crash-dive, there was no time to hang around on deck or on the bridge. By necessity, they had to disappear down the hatch as fast as possible and the last person to slide down the ladder was usually the commander who was also responsible for securing the hatch from inside.

To submerge, the crew first opened vents at the top of the ballast tanks to release air. Because the bottom of the ballast tank was open to the sea, water flooded in to

RIGHT Flooding the tanks prior to crash-diving, May 1944. *(Jonathan Falconer collection)*

DIVING PROCEDURES

All U-boats followed a strict diving procedure. These were carefully followed even in the direst emergency situation, since skipping a step could sink the boat, killing everyone aboard. Diving procedures were usually rehearsed each day along the following lines:

- ***Clear the bridge*:** The commander ordered decks and bridge to be cleared before diving and everyone topside quickly disappeared below deck.
- ***Stop engines*:** In the control room, the petty officer of the watch gave the order to stop engines and switch to battery power. Diesels engines were shut down and crew in the electrical motor room took the motors off generator power and put them on battery power. At the same time speed was set at 'all-ahead' two-thirds.
- ***Close main induction*:** The main induction was a large air intake pipe located aft of the conning tower. It had to be closed before diving or the engine rooms would fill with water.
- ***Open main vents*:** Ballast tank vents were opened, allowing the tanks to fill with water. As soon as there was pressure in the boat, the negative tank was flooded to increase diving speed.
- ***Rig-out bow planes*:** The bow hydroplanes, usually kept folded against the superstructure to prevent damage while surfaced, were fully rigged out and set on full dive. Stern planes were used to control the boat's angle.
- ***Close vents:*** All vents were closed when the boat reached a depth of 13.7m. Speed was reduced to two-thirds normal speed.
- ***Blow negative*:** Once the depth was 4.5m short of the desired depth, flooded negative tanks were blown to restore neutral buoyancy. This tank was never blown completely dry at sea in order to avoid sending air bubbles to the surface. Once the flood valve was shut, excess air pressure was vented into the hull.
- ***Level off:*** At the desired depth, the boat was levelled off and slowed to one-third speed. Vents were cycled and any necessary adjustments required were made to the trim. Once all was correct, the commander was informed.

take its place as soon as air was released. Displacement then increased and the boat could then quickly slip beneath the surface.

U-boats – like other submarines – were designed so that when the main ballast tanks were full, the weight of the water displaced was as near as possible equal to the weight of the boat. The boat retained a small amount of buoyancy to allow it to slowly rise to the surface if nothing occurred to keep it submerged.

In addition to the main ballast tanks – kept either empty or completely full – there were other variable ballast tanks inside the pressure hull, including bow and stern, trim tanks, negative and safety tanks.

When crash-diving, negative tanks were important. By flooding this tank, the submarine became negatively buoyant allowing it to get underwater faster. Once submerged, the negative tank was blown or pumped out to restore neutral buoyancy. If the tank remained full and all power was lost, the boat would quickly sink below its permitted crush depth, killing everyone on board in the process.

The safety tank, normally kept fully flooded while submerged, was designed to hold the same volume of water as the conning tower. If the conning tower flooded for some reason, it had to be abandoned and the safety tank blown dry to compensate.

Buoyancy and trim tanks were used to adjust the centre of balance of a submerged submarine. By pumping air and water back and forth between them, the diving officer could balance the boat.

Type VII U-boats also had fuel ballast tanks. Diesel fuel was kept in these open-bottomed tanks and because diesel fuel is lighter than water, it floats at the top of the tank where it could be drawn off and used. As fuel was used, its place was taken by water, allowing the tank to remain full.

ABOVE A lookout on the bridge of a U-boat scans the horizon for signs of a convoy.

BELOW A rare photograph showing a U-boat newly surfaced directly into the sea lane of an enemy convoy. At the same time as this photograph was being taken from the bridge by a crew member, the commander would already have one of the two ships pictured in his attack periscope sights and the order to fire a torpedo would be given. As soon as the torpedo had left the submarine, the U-boat would crash-dive out of sight before – possibly – returning later to create more havoc for the convoy. *(Through Their Eyes)*

Achtung Wolfsrudel! – beware wolfpacks!

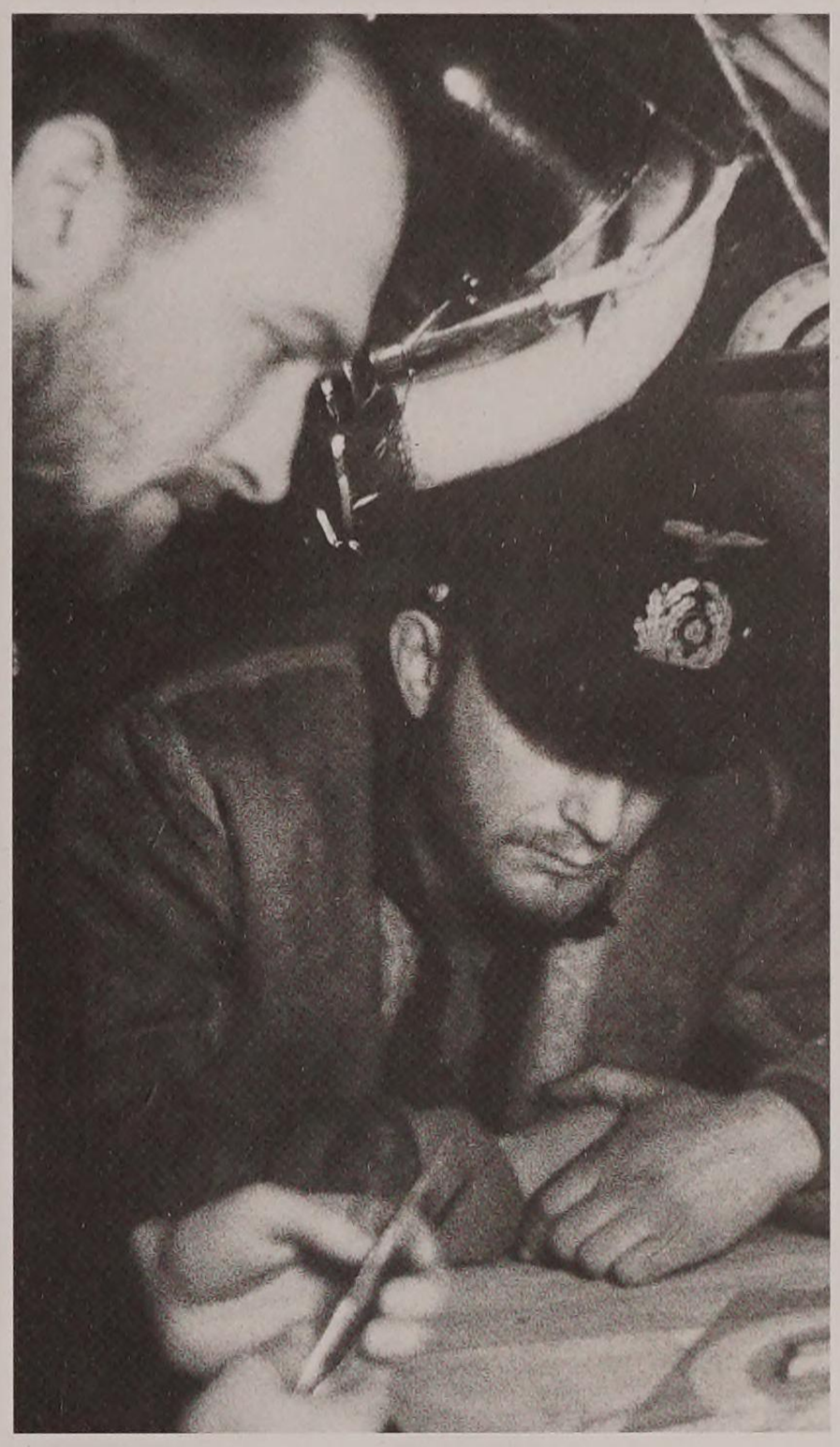
It was Admiral Dönitz himself who, in June 1940, first used the term *Rudeltaktik* (herding tactics) to describe his strategy of submarine warfare. He likened U-boat tactics to herds of hungry wolves working together to stalk, attack and kill their prey. Submarine groups taking part in these deadly tactics became known as the 'wolfpack' (*wolfsrudel*) and their tactics had a devastating impact on Allied ships carrying food, raw materials and oil across the Atlantic to keep Britain's lifeline open.

When submerged, U-boats were slow, but on the surface they were faster than any convoy of merchant ships. Dönitz knew that Britain would do everything it could to protect essential Atlantic trade using a system of convoys with warship escorts providing defensive support. U-boat movements were controlled by Dönitz in his role as Commander of Submarines (*Befehlshaber der Unterseeboote – BdU*). After working as a submarine commander himself during the First World War, Dönitz knew that submarines could effectively work together,

capitalising on the vulnerability of convoys – just like a pack of hungry wolves would. In 1973, Dönitz recalled for the British television series *The World at War*:

> *In October 1918 I was captain of a submarine in the Mediterranean near Malta and in the dark of night we met a British convoy of cruisers and destroyers. I attacked and sank a ship, but the chance would have been very much greater if there had been more submarines. That's how the idea of the 'wolfpack' came about, putting submarines together to attack. That's why in all the years from 1918–1935 I had never forgotten the idea.*

The 'wolfpack' concept was simple and when conducted using a combination of solid military tactics, good judgement and luck, it worked well. Using radio, the *BdU* ordered U-boats to gather into groups. Around 250 wolfpack squadrons were formed during the war, some operating for a few days and others for several months. The number of U-boats in each pack ranged from 3 or 4 to 20–34, with the largest



LEFT The navigation officer consults his charts.

BELOW A November 1942 convoy moving eastwards across the Atlantic bound for Casablanca. But what lies beneath? *(Library of Congress)*

ABOVE **An Arctic convoy makes its way slowly through the ice flows.**

RIGHT **Otto Kretschmer (1912–98) was the most successful of the wartime aces of the deep. As commander of U-35, U-23 and U-99, he sank 47 merchant ships totalling 272,043grt over a short period, before being captured in March 1941 and spending the rest of the war in a Canadian prison camp.** *(Bundesarchiv)*

groups hunting for enemy convoys in the North Atlantic, off the east coast of the USA, the Caribbean and the Arctic Ocean. Attacks were sometimes aided by Focke-Wulf Condor reconnaissance aircraft, which located convoys and relayed information back to the *BdU*.

Wolfpack patrols operated under different code names starting with *Adler* and *Arum* and running through to *Ziethan* and *Zorn*, with other names in between borrowed from characters in Wagner operas (*Wotan* and *Siegfried*) or given heroic names (*Erasmus, Arrow, Panzer, Lionheart, Jaguar* and *Leopard*).

Once a convoy was located, a single U-boat was designated as the 'shadower' to stalk and follow the ships and their escorts. Information about convoy direction and speed was reported back to the *BdU*, which ordered submarines to position themselves around the flotilla and make their deadly attack using as many boats as possible. Attacks usually took place under the cover of night when a U-boat's silhouette was almost invisible – unlike the convoys, which were lit up and clearly outlined against the night sky.

Despite the U-boat threat, the convoys ploughed on knowing full well what dangers

lurked beneath the waves. Wolfpacks sank vast numbers of merchant ships in the Atlantic and did serious harm to Britain's sea trade. In April 1940, after eight patrols, Commander Otto Kretschmer – who became the Kriegsmarine's number one U-boat ace – was transferred to the newly completed Type VIIB boat U-99. He took his boat into action in June 1940. During its first four patrols, U-99 silently sprang surprise night attacks on convoys and sank merchant ships with highly accurate shots, using the 'single torpedo per target' principle. The quote 'One torpedo, one ship', is attributed to Kretschmer.

Kretschmer was one of the first commanders to take his submarine into the heart of a night-time convoy. He believed no escort commander would ever believe that a U-boat could deliberately find its way into the middle of such a large flotilla to make an attack. On the night of 18 October 1940 he proved them wrong when five boats went into a wolfpack attack – U-46, U-100, U-101, U-123 and U-99 captained by Kretschmer. The convoy was made up of 35 merchant ships and 6 escorts sailing eastbound from Nova Scotia for Liverpool and travelling under the code name SC-7. The escort was completely overwhelmed and 20 of the 35 cargo vessels were sunk or damaged, with 141 lives lost. Kretschmer later recalled:

> *I tried to get through the convoy escorts and failed. They saw me and started shooting, but I tried again and succeeded [the] second time to get inside the convoy going up and down the lanes looking for the most important and most valuable ships. I fired 12 torpedoes in all.*
>
> *This was the first time that we had experienced these tactics – and the first time that Dönitz had been able to put the wolfpack plan to the test. The night became known as the 'Night of the Long Knives' because so many ships were sunk.*

Seven of the sunken ships were victims of Kretschmer's U-99. The total tonnage lost that night was 79,592grt. Not a single wolfpack U-boat was damaged and Kretschmer earned another nickname that night – '*Stille Otto*' (Silent Otto) – in recognition of his silent-running techniques.

The disastrous outcome for the convoy demonstrated the U-boat's potential of being able to work efficiently using wolfpack tactics – and the inadequacy of Britain's anti-submarine tactics at that time.

While wolfpacks continued to be a serious threat to British and Allied shipping, the Allies developed countermeasures to turn the U-boat organisation against itself. To succeed, wolfpacks needed extensive radio communication to coordinate attacks. This left wolfpacks vulnerable to a device used by the Allies called the High Frequency Direction Finder – HF/DF or 'Huff-Duff' as it became known – which allowed Allied naval forces to determine the location of enemy boats and attack them. Effective air cover by long-range planes with radar and escort carriers allowed U-boats to be spotted as they stalked their convoys and prepared to attack. Atlantic destroyers also used depth charges and other small mines that could be dropped over a ship's side.

Between July and October 1940, 282 Allied ships were sunk in the Western Approaches amounting to over 2 million tons of merchant shipping. Dozens of medals were awarded to wolfpack commanders and their crews. This period became known as '*Die Glückliche Zeit*' – 'The Happy Time'.

The United States was in a fortunate position when it declared war on Germany in December 1941. Whereas Britain and her Allies had already lost thousands of servicemen and were experiencing shortages of ships, the Americans at that time were operating at full capacity.

America had the opportunity to learn about modern naval warfare by observing events taking place in the North Atlantic thanks to its close relationship with the UK. The US Navy had also gained experience encountering Atlantic U-boats, particularly from April 1941 when President Roosevelt extended the Pan-American Security Zone east as far as Iceland.

Dönitz considered entry of the US into the war as a golden opportunity to strike heavy blows in the tonnage war. Yet, despite great U-boat successes during the first year of the war, Germany finally lost the Battle of the Atlantic following the introduction of new Allied weapons and improved tactics. The turning point was

RIGHT Seen from the deck of an aircraft carrier, a merchant ship is bombed in Convoy PQ18. Sailing from Scotland on 2 September 1942 it was the biggest Allied Arctic convoy to Russia. It fought through a four-day attack by a wolfpack of 12 U-boats and dozens of torpedo bombers to deliver its cargo to the Arctic port of Archangelsk almost three weeks later. Out of 40 merchant ships, 13 were sunk.

marked by a series of convoy battles between March and May 1943, which ended in the decisive defeat of the German U-boat menace. It was at that time that the hunters became the hunted and the 'happy times' ended.

During the war, about 60% of all German U-boats commissioned were lost in action. Despite huge submarine losses, the U-boat fleet – to quote from the British official account of the Battle of the Atlantic – fought 'to the very end with discipline and efficiency. There was no relaxation of effort or hesitation to incur risks.'

In 1940 Grand Admiral Dönitz had written: 'The U-boat alone can win the war. Nothing is impossible . . .' and he was very nearly right.

RIGHT Gunners on U-435 (*Kapitänleutnant* Siegfried Strelow) prepare to finish off the Norwegian merchantman SS *Norse King* with gunfire on 29 December 1942, 600 miles due west of Brest. Convoy ONS154 had been stalked by twenty U-boats of Groups *Spitz* and *Ungestum*. Nine merchantmen were sunk. *(U-boat Archive)*

U-BOAT ACES OF THE DEEP

Nearly 70 years after the Second World War, German people still remember with pride and admiration a group of over 30 U-boat aces who collectively sent millions of tons of shipping to the bottom of the sea. The names of Otto Kretschmer, Wolfgang Lüth and Erich Topp are as familiar to Germans of all ages as Field Marshal Montgomery and Battle of Britain aces Guy Gibson, Douglas Bader and Robert Stanford-Tuck are to those in the UK. Together with the U-boat aces, they share the same kind of charisma and warrior instinct.

Like their British counterparts in the Royal Navy, RAF and the army, many U-boat aces lost their lives before the end of the war. Others became prisoners of war, later returning home to begin their lives anew. Some became senior members of commercial, government and military organisations. They were dignified men with tremendous leadership qualities who gained their early experience as young men with the Kriegsmarine and carried it over into new lives in post-war Germany. Most of them were modest men who did not particularly enjoy talking about their wartime experiences once it was over. Many years later and, if pressed, some agreed to speak to writers and television programme-makers about their long-ago lives as submarine commanders. None of them boasted of their U-boat successes, simply acknowledging that, like their former enemies in Europe and the United States, they did what they had been told to do – accepting orders and carrying them out. Some wrote personal memoirs and many became best sellers, but most U-boat aces kept silent, letting others tell their stories for them.

They – like their fellow crew members – were nothing like the false and misleading image once peddled by propaganda maestro Dr Goebbels to the German masses in his newspapers, radio broadcasts and cinema newsreels. Here is a brief overview of the Kriegsmarine's top three U-boat aces:

Fregattenkapitän **Otto Kretschmer** (1912–98) was the most successful of the Second World War aces of the deep. As commander of U-35, U-23 and U-99 he sank 47 merchant ships totalling 272,043grt in a short period of time before being captured in March 1941 and spending the rest of the war in a Canadian prisoner of war camp. After the war, he rejoined the German Navy – now renamed the Bundesmarine – and became NATO Chief of

LEFT Otto Kretschmer was the most successful U-boat commander of the war. Here he enjoys a bottle of Beck's (the crew's favourite beer, which bears the coat of arms of the city of Bremen on the label) after returning to port following a long war patrol. *(Bundesarchiv)*

RIGHT After the war Kretschmer rejoined the German Navy (renamed the Bundesmarine) and became NATO Chief of Staff in May 1965. He retired in September 1970 with the rank of *Flottillenadmiral*. *(Bundesarchiv)*

Staff in May 1965. He retired in September 1970 with a rank of *Flottillenadmiral*. During his time as a U-boat commander, he was given the nickname 'The Tonnage King' because of his superb record in sinking vast numbers of vessels. In the early 1970s – and after much persuading – Kretschmer agreed to give a television interview for an episode of

RIGHT Wolfgang Lüth (1913–45) was given command of U-9 in December 1939 and went on to command U-13, U-138, U-43 and U-181, sinking 46 merchant ships for a total 225,204grt in 15 patrols, including one which lasted 205 days – the second longest of the war. *(Bundesarchiv)*

FAR RIGHT Wolfgang Lüth celebrates with his crew after taking command of U-181, which sank 27 ships amounting to 138,779grt. *(Bundesarchiv)*

the award-winning British television series *The World at War* and called 'Wolf Packs: U-boats in the Atlantic 1939–1944'. In the programme, the former U-boat ace looked uncomfortable before the cameras, but spoke openly about his days hunting the enemy and sending thousands of tons of shipping to the seabed. He died at the age of 86 in a boating accident on holiday on the River Danube in the summer of 1998 while celebrating his 50th wedding anniversary. He was cremated and his ashes scattered at sea.

Second in the league is *Kapitän zur See* **Wolfgang Lüth** (1913–45). Lüth was given command of U-9 in December 1939, going on to take charge of U-13, U-138, U-43 and U-181. He was responsible for the sinking of 46 merchant ships for a total 225,204grt in 15 patrols, including one lasting 205 days – the second longest of the war. In January 1944 Lüth took command of the 22nd U-boat Flotilla, before being appointed commander of the marine academy at Mürwik. There he was mistakenly shot and killed by a German sentry on 13 May 1945.

Fregattenkapitän **Erich Topp** (1914–2005) commanded U-57 and U-552 in 1940 and 1941 and sank 35 merchant ships for a total of 197,460grt. He commanded the tactical training unit of the 27th U-boat Flotilla from late 1942 and briefly served as commander of the Type XXI *Elektroboote* U-3010 and U-2513 before the end of the war. He rejoined the Bundesmarine in 1956, reaching the rank of *Konteradmiral* before retiring in 1969. Like Otto Kretschmer, he was often called upon to talk to writers and television companies about his wartime experiences – and was generally happy to do so. Those in the media found him charming and courteous and were happy for him to correct any inaccuracies he discovered in their work. He freely admitted to making mistakes during his wartime years which cost lives – and said he bitterly regretted them. He lived long enough to act as a technical adviser on cinema films and computer games featuring U-boats, loving every moment of lending his expertise to the peacetime generation. He died in December 2005 at the age of 91.

FAR LEFT Erich Topp (1914–2005) commanded U-57 and U-552 in 1940–41 and sank 35 merchant ships for a total of 197,460grt. *(Bundesarchiv)*

LEFT Type VIIC boat U-552 under the command of Erich Topp returns to St-Nazaire after another successful war patrol. *(Bundesarchiv)*

Bibliography

Beaver, Paul, *U-boats in the Atlantic* (Patrick Stephens, Cambridge, 1979).

Botting, Douglas, *The U-boats* (Time-Life Books, Amsterdam, 1979).

Buchheim, Lothar-Günther, *U-boat War* (Bantam Books, New York, 1978).

Busch, Harald, *U-boats at War* (Putnam & Co. Ltd, London, 1955).

Churchill, Winston S. *The Second World War* – Volume II, *Their Finest Hour* (Cassell & Co. Ltd, London, 1949).

Dönitz, Admiral Karl, *The Conduct of the War at Sea* (US Navy Department, Washington DC, 1946).

Hoyt, Edwin P., *U-boats* (Stanley Paul, London, 1987).

Lenton, H. T., *German Submarines 1* (Macdonald, London, 1965).

Lenton, H. T., *German Submarines 2* (Macdonald, London, 1965).

Mulligan, Timothy P., *Neither Sharks Nor Wolves: The Men of Nazi Germany's U-boat Arm, 1939–1945* (Chatham Publishing, London, 1999).

Stern, Robert C., *Type VII U-boats* (Brockhampton Press, London, 1991).

U-boat Information for Type VIIC, Kriegsmarine Official Instruction Number 371/181, Reich Penal Code 88, 24 April 1934.

Werner, Herbert A., *Iron Coffins*: *A U-boat Commander's War, 1939–1945* (Cassell Military Paperbacks, London, 1999).

Wetzel, Eckard, *U-995: The Submarine at the Naval Memorial in Laboe* (Karl Müller Verlag, Erlangen, 1995).

Williamson, Gordon, *U-boat Crews: 1914–45* (Osprey Publishing, Oxford, 1995).

Williamson, Gordon, *Grey Wolf: U-boat Crewman of World War II* (Osprey Publishing, Oxford, 2001).

Williamson, Gordon, *Kriegsmarine U-boats: 1939–45* (Osprey Publishing, Oxford, 2002).

Witt, Dr Jann M., *Of Black, Red and Gold (Von Schwarz-Red-Gold): A Short History of the German Marines from 1848 to Today* (Deutscher Marinebund e.V., Laboe/Palmedia Publishing Services GmbH, Berlin, 2011).

Index

Aces 129, 131, 151-153
Against England newspaper 45
Aircraft 110, 142-143, 149; Arado Ar 231 32; Armstrong Whitworth Whitley 110; Consolidated B-24 Liberator 30, 58, 65, 126; de Havilland Mosquito 142; Fairey Swordfish 45, 123; Focke-Wulf Condor 148; Messerschmitt Me262 31; Short Sunderland 23, 64, 116
Aircraft kills 115-117
Allied ships sunk 5, 11, 18, 23, 27, 38, 42-46, 48-51, 56, 58-61, 63-65, 72-74, 76, 78, 111, 126 146, 148-153
Ammunition storage 84, 105, 107, 112, 129
Anchors 81-82
Anglo-German Naval Agreement 17, 21, 74
Antennas 25
Anti-Submarine Defence School 16
Anti-submarine nets 48, 85-86
  serrated net-cutters 86
Arctic convoys 148, 150
Armament 72; anti-aircraft (flak) guns 28, 32, 60, 110-111, 113-117; anti-aircraft rockets 111; deck guns 22, 26, 28, 42, 48, 73, 81, 110-117, 129, 134, 142; 127mm guns 32
Atlantic convoys 18, 48, 51, 56, 63, 76, 105-106, 121, 125, 129, 143-144, 146-150
  escorts 56-59, 63, 106, 120, 129, 144, 149
Awards and decorations 50-51, 124, 149

Badges and emblems 11, 51, 123
Ballast and buoyancy tanks 27, 43, 73, 75, 80-81, 83-84, 88, 96, 98, 100, 102, 105, 129, 143-145
Bases 52-56; Bay of Biscay 24, 53, 55, 63; Bordeaux 53; Brest 53, 116, 123, 128; Hamburg 45; Kiel-Dietrichsdorf 16, 42, 45; La Rochelle 53; Lorient, Bay of Biscay 14, 18, 27, 42, 52-53, 110; Saint-Nazaire 5, 42, 52-53, 153; Trondheim 54; Wilhelmshaven 42, 50, 65
Battle of Britain 6, 151
Battle of the Atlantic 10, 16, 19, 32, 57, 149-150
Battle of the Barents Sea 21
Binoculars 131, 134, 142
Bremerhaven U-Boot Museum 36
Bridge 16, 85, 98-100, 111, 131, 134, 142, 144-146
Buchheim, Lothar-Günther, author 19, 76, 128-130
Builders 15-16, 54-55, 76; AG Vulcan 15-16; AG Weser 15-16, 27, 29, 35, 42, 73, 80; Blohm & Voss 9, 15, 33, 35, 39, 54; Bremer Vulkan-Vegesacker Werft 74; Crichton-Vulcan 16; Deutsche Werft 29, 37-38; Deutsche Werke 16-17; Flender Werke 74; F. Schichau 35, 37; Howaldtswerke-Deutsche Werft 38-39; IvS 15-16; Krupp Germaniawerft 14-16, 26, 30-31, 37-38, 73-74, 79; Linzer Werft 37; Seebeckwerft 29; ThyssenKrupp 39
Bulkheads 92, 102, 129
Busch, Harald, submariner author 73, 138

Cargo-carrying submarines 31
Chicago Museum of Science and Industry 29, 67
Christmas on patrol 137-138
Churchill, Winston 6, 45, 51, 57, 63, 65, 123, 125
Command headquarters 103-104
Commanders (Kommandants) 15, 83, 98, 123, 126-127, 138, 144-145, 148, 151; accommodation 98, 103, 129
Communications 42, 72
Conning tower 16, 25, 37, 43, 51, 71-72, 75, 82-83, 85, 99-100, 110, 112-114, 124, 129, 135, 144-145
  bandstand and winter garden 110, 114-115; hatch 99-101
Control rooms 42, 72, 75, 83, 98-102, 135
Crash diving 35, 37, 46, 111, 138, 142-146
Crew members – chief engineer 94, 106, 127, 136; cook (Smutje) 96, 128, 135-139; diesel engine officer 127; electric engine officer 127; gun 112-113, 115-116, 128; helmsman 98, 101, 111; lookouts 142, 146; machinists 128, 130; navigators 127, 138, 147; petty officers 96-97, 103-104, 106, 128-131, 138-139, 145; planesman 98, 101-102; radio operators 103-104, 128, 130, 134; seamen 128, 130, 134, 138-139; telegraphists 103-104; Torpedo Boys 118, 127, 130; warrant officers 129; watch officers 106, 113, 127, 145
Crews 22-23, 25, 32, 35, 65, 75, 96, 123-128, 139; average age 125-126; life expectancy 6; lost 11,19, 23, 38, 42, 62-65, 74, 76, 79, 123; psychological toll 135; taken prisoner 42, 62, 67, 72, 124, 133, 136, 148, 151; training 16-17
Crush depth 145

Das Boot book and film 19, 76
Day of Commemoration of Heroes 11
Depth charges 11, 23, 42, 58, 61, 72, 74, 76, 111, 123-124, 126, 129, 138, 143, 149
Design and build programme 15, 23, 26, 54-55, 64, 74; costs 23, 42; factories bombed 64; forced labour 35, 52, 54, 77; non-German construction 15-16, 37; overseas sales 16, 39; Valentin bunker 35; workforce required 55
Diesel exhaust fumes 24-25, 88, 138
Dive planes 80, 87
Diving procedures 145
Dönitz, Grand Admiral Karl 9, 17-21, 25, 32-33, 48, 50, 56-60, 63, 65, 75-76, 103, 111, 114-115, 124-125, 146-147, 149-150; appointed Head of State 18-19, 32; end-of-war ceasefire order 32, 34; tried for war crimes 9, 17, 19, 64
Dönitz, *Leutnant* Peter 63-64
Drainage holes 84, 99

Electrical system 76; battery hatches 82; generators 93; wiring 84
Electronic equipment 42, 72
Engine room telegraph 95, 99, 102

Fehler, *Kapitänleutnant* Johann-Heinrich 32
First World War 10-11, 13-15, 44-47, 74, 146
  Armistice 47
Flensburg Government 18-19
Food and drink – see Provisions
French Navy
  Roland Morillot (ex-U-2518) 36
Fuel oil tanks and system 27-28, 43, 72-75, 77, 84, 88-89, 98, 102, 105, 107, 111, 129, 135, 145

Galley 82, 96-97, 135-136, 138-139
Gerhold, first-class sailor Walter 124
German High Seas Fleet 47-48; *Baden* 47; *Derfflinger* 47; *Emden* 47; *Frankfurt* 47; *Nürnberg* 47
German Naval Armed Forces/ German Federal Navy (Bundesmarine) 38-39, 151-153; *Wilhelm Baur* (ex-U-2540) 36
German surrender 1918 47; 1945 43, 54, 64-65
Goebbels, Dr Joseph 44, 116, 151
Godt, *Kapitän zur See* Eberhard 19
Gräf, *Kapitänleutnant* Ulrich 76
Great German Art Exhibition, Munich 1941 10

Happy Times, The 56, 60, 63, 76, 149-150
Hedgehog anti-submarine projector 58
Henschel Hs 293 glide bomb 31
Historic Warships at Birkenhead 30
Hitler, Adolf 19, 21, 43, 50, 59, 63, 65, 114; becomes Reich Chancellor 15; death 18, 32, 34; Plan Z 42; Hitler Youth 10, 124
Hulls 26, 32, 35, 37, 39, 73, 76-77, 79-80, 82-85, 92, 102, 145; cross-sections 93, 96, 98, 105, 107
Hydrogen peroxide fuel 33
Hydrophones and sonar 24, 56, 75, 103,105-106, 143, 144
Hydroplanes 27, 37, 83, 87, 89, 100, 102-103, 145

Interior lighting 135

Japanese Navy 32, 62; I-505 (ex-U-219) 32
Jellicoe, Admiral John 47
Jensen, Aage, salvage diver 30
Jodl, Alfred 18
Jumping wire 85

Keel 71
Klingspor, *Kapitänleutnant* Leonard 65
Kolonie und Heimat magazine 124
Kretschmer, *Kapitänleutnant* Otto 74, 76, 148-149, 151-153
Kriegsmarine (German Navy) – throughout; fleet limitation 13-14, 16-17; Monsoon Group 79; renamed from Reichsmarine 15; *Scharnhorst* 80; 2nd U-boat Flotilla 42; 7th U-boat Flotilla 48, 51; 22nd U-boat Flotilla 153; 27th U-boat Flotilla 153
Kuppisch, *Kapitänleutnant* Herbert 100

Laboe Naval Memorial, 13-14, 67, 77-78
Ladders 98-99
Lemp, *Kapitänleutnant* Fritz-Julius 18, 43-44
Living conditions and facilities 11, 22, 35, 107, 128-139; bunks 22, 96-97, 103, 106, 129-130, 136; clothing 130-131, 135, 137; Colibri deodorant 135; cooking facilities 22, 96; hammocks 130, 139; lockers 130; meals 135-137; off-duty leisure 129, 134-135; petty officers' mess 96-97, 130; toilets (WCs/'the heads') 11, 22, 98, 106, 128, 130, 132-133, 138; warrant officer's mess 106
Lubrication system 75
Lüth, *Korvetenkapitän* Wolfgang 123,151-153

Marine Construction Co Ltd 30
Merchant ships 43; SS *Athenia* 43-45; SS *Blairlogie* 44; *Bosnia* 48; *Collingworth* 45; *Dixie Arrow* 61; ORP *Dragon* 124; SS *Fanad Head* 44; *Hannover* 58-59; SS *Norse King* 150; SS *Pennsylvania Sun* 62; *Ranella* 42; *Susan Maersk* 42; *Veendam* 45
Minefields 16, 28, 121
Mines 26, 28-30, 78, 89, 115, 118, 121, 149
Minesweeping 121
Ministry of War Transport 59
Morgenrot (*Morning Red*) film 15

Navigation 11, 26, 56, 98, 100-101, 104-105, 127, 129, 147; Naval Grid System 56
Night attacks 28, 48, 56, 76, 148-149
North German Lloyd 58-59

Operation Deadlight 66-67, 79
Operation Drumbeat 28, 60, 63
Operational theatres – Arctic Ocean 79, 148; Baltic 23-24, 143; Bay of Biscay 111, 115-116; Caribbean 59, 148; English Channel 85; Indian Ocean 79; Mediterranean 21, 59, 114, 143; North Atlantic 10, 21, 25, 28, 33, 60, 63, 65, 76, 79, 116, 134, 148-149; North American coast 57, 60-61, 85, 148; North Sea/ Norway 23, 45, 59, 79, 124; Pacific 79
Organisation Todt 52-53
Oxygen supply 25

Pearl Harbor 57
Performance 22-29, 31, 33, 35, 37-39, 43, 72-74, 77, 92, 94, 111, 143
Periscopes 11, 25, 27-28, 77, 83, 98-99, 101, 131, 142-144, 146
Periscope depth 24, 142-144
Port of Londonderry, Lisahally 66-67
Potsdam Agreement 36-37
Prien, *Kapitänleutnant* Günther 48-51, 74, 76
Production figures 9, 11, 13, 16, 20-22, 26-29, 33, 35, 38-39, 63, 72-74, 76-77, 125
Propellers 27, 37, 81, 83, 87-88
Propulsion 26, 71; air-independent 39; batteries and room 24, 35, 37, 63, 92-96, 98, 105, 107, 129, 133, 144-145; diesel-electric 39; diesel engines and room 22-23, 26, 33, 35, 37, 72, 74-76, 78-79, 92, 94-96, 145; air intake 95, 145; temperature gauges 95; electric motors and room 22-24, 26, 33, 35, 72, 75-76, 78, 92-94; hydrogen fuel cell 39; steam turbines 39; V-80 engines 33
Provisions loading and storage 96-9 7, 107, 129, 132, 135-136, 138; alcohol 139; Führer's food parcel 136

Radar 24, 32, 56, 63, 106, 149
Radio communications 16, 103-105, 129, 147, 149
Raeder, Grand Admiral Erich 15, 18, 20-21, 50, 57, 63
Repairs and maintenance 14, 55, 57
Roosevelt, President 57, 63, 149
Royal Air Force (RAF) 31, 111, 116, 151; Coastal Command 59, 143; 59 Squadron 59, 65; 77 Squadron 110
Royal Canadian Navy 29, 56-57
Royal Australian Air Force (RAAF) No 10 Squadron 23, 64
Royal Navy 17, 20, 43-49, 58-59, 65-66, 74, 151; HMA *Audacity* 58-59; HMS *Courageous* 44-45; HMS *Fame* 76; HMS *Forester* 42; HMS *Fortune* 42; HMS *Gladiolus* 23; HMS *Icarus* 124; HMS *Inglefield* 74; HMS *Intrepid* 74; HMS *Ivanhoe* 74; HMS *Kashmir* 124; HMS *Kingston* 124; HMS *Narwhal* 16; HMS N41 (ex-U-3017) 37; HMS *Royal Oak* 49-52; HMS *Salmon* 23; HMS *Vindex* 123
Royal Norwegian Navy, 78; RNS *Kaura* (ex-U-995) 67, 78
Rudders 27, 37, 74, 80-81, 83, 86-87, 95, 102

Scapa Flow, Orkneys 46-52
Scheer, Lt Cmdr Werner 42
Schepke, *Kapitänleutnant* Joachim 74, 76, 129
Schmutzer, Private First Class Jacob 126
Schnee, *Korvetenkapitän* Adalbert 19
Schug, *Oberleutnant* Walter 111
Schuhart, *Kapitänleutnant* Otto 44-45
Secret missions 31, 65
Skeg 27, 87
Snorkel 24-26, 35, 37, 66
Snorkelling 24, 38, 95
Soviet Navy 36-37
Specifications 23, 31-32, 35, 39, 70-71
Steering 83, 95, 102-103
Stock, Commander Rupprecht 78
Strelow, *Kapitänleutnant* Siegfried 150
Submarine E-1 15
Surviving U-boats – U-505 29, 67; U-534 29-30; U-995 6, 9, 13-14, 67, 77; U-2540 36
Telescopic masts 25
Topp, *Kapitänleutnant* Erich 5, 11, 35, 60, 131, 151, 153
Torpedo tubes and hatches 22, 26, 28, 31, 73-74, 76, 80, 82, 92, 107, 117-118
Torpedo compensating tanks 89, 107
Torpedo room 92-94, 107, 117, 129-130, 135
Torpedoes 9, 11, 26, 31-32, 34, 42, 44, 48-49, 60, 62-63, 65, 73, 75, 79-80, 83-84, 89, 107, 110-111, 117-120, 130, 144, 146, 149; gyroscope 120; homing 120; acoustic 120; launching 118; pattern-running 120-121; pistol triggers 120; slang name 118-119; straight-running 118, 120; transferring to U-boat 79, 119; wet heat propulsion 120
Treaty of Versailles 13, 15-17, 20, 42
Trim changes 89, 93, 145

U-boats illustrated – U-1 16; U-6 21; U-7 14; U-26 23; U-27 72; U-31 14; U-36 23; U-37 27; U-71 61; U-86 111; U-101 43, 73; U-103 28, 113; U-110 18; U-124 104; U-142 119; U-148 10; U-181 152; U-185 62; U-293 65; U-295 67; U-373 117, 136, 139; U-390 100, 119; U-402 63; U-409 28; U-426 64; U-435 150; U-460 60; U-532 67; U-534 30; U-552 5, 131, 153; U-553 42; U-586 126; U-604 28; U-653 123; U-659 28; U-805 29; U-889 29; U-977 75; U-995 6, 9, 13, 77, 101, 114, 118, 132, 139; U-1009 66; U-2360 39; U-2363 38; U-2502 142; U-2511 34; U-2513 25, 35; U-3008 25
U-boats losses (sunk) 5, 11, 14, 16, 18, 23-24, 30, 32, 38, 42, 57-59, 62-65, 67, 72-74, 79, 116-117, 120, 123, 150
Black May 63
U-boats raised from the seabed 30, 36, 38
U-boats re-used by other navies 35-38
U-boats scuttled 5, 23, 27, 32, 36-38, 43, 47, 58, 66-67, 79, 94, 127, 133
U-boats surrendered/captured 29, 31-32, 34, 37, 63, 65-67, 75, 78, 136
U-boat Training Academy 17
U-boat transport by rail 37
U-boat types – I 21; IA 23; II 16, 20-22, 26, 46, 73, 125; IIA 16, 20-22; IIB 22; IIC 22, 24; IID 22; VII 16, 21, 23 *et seq*; VIIA 14, 23, 26, 42-43, 70, 72-73, 83, 111, 119; VIIB 42-43, 70, 73-75, 111, 149; VIIC 5, 13, 24, 32, 42, 46, 52, 58, 61-62, 64, 70, 75-77, 107, 110, 115, 123, 126, 131, 133, 136, 143, 153; VIIC/41 9, 65-66, 71, 76-78, 83, 101; VIIC/42 71, 77; VIID minelayer 71, 78-79, 115, 121;VIIE 79; VIIF torpedo supply 71, 79; IX 21, 27-28, 54, 76, 115; IXA 28; IXB 28; IXC 24, 29, 46, 77; IXD 28, 32, 77; X 30; XA 30; XB 30-32; XI artillery 32; XII 33; XIV milk cow (ex-IXD) 32, 60; XVIIA 33; XVIIB 33-34; XVIII 34; XXI Elektroboote 24-25, 34-38, 64, 78, 142, 153; XXII 24; XXIII 25, 37-39, 64-65; 205 39; 206 38; 209 39; 212 39; 214 39; 216 39; U5 14; U-flak (Flak Trap) submarines 110, 115-117; U-Flak 1 115
USAAF 126
US Navy 29, 31, 35, 62-63, 149; USS *Barker* 62; USS *Card* 63; USS *Sutton* 32

Ventilation tanks and system 24, 82, 84
von Forstner, *Korvettenkapitan* Siegfried Freiherr 63
von Reuter, Rear Admiral Ludwig 47
von Ribbentrop, Joachim 17
Walter, Hellmuth 32-33, 37
Walter Boats 34
Walter-Werke 33; V-80 33
War patrols 23, 27, 34, 36, 38, 42, 117, 126, 130, 135, 137, 151-152
Watch system (Deck patrol) 97, 106, 131, 134, 142
Water (fresh and waste) 98, 107, 135
Wilhelmshaven marine observatory 45
Willrich, Wolfgang, artist 127
Wolfpack tactics 18, 28, 58-60, 64, 76, 126, 146-150, 153
World at War, The television series 147, 153

Zshech, *Kapitänleutnant Peter 29*

U-BOAT

1936–45 (Type VIIA, B, C and Type VIIC/41)

ABOVE **American oil tanker SS *Pennsylvania Sun* was torpedoed by Type VIIC boat U-571 on 15 July 1942 200km west of Kay West, Florida. The tanker was later salvaged and returned to service.** *(Library of Congress)*

ABOVE **A poster for the 13th US Naval District showing Japanese and German submarines and planes targeting a ship on the horizon.** *(Library of Congress)*

RIGHT **U-185 sinking on 11 August 1943 after being bombed by US carrier-borne aircraft south-west of the Azores. More than 40 men managed to reach the deck and jump into the sea as their boat sank. Some 36 men were later rescued by destroyer USS *Barker*, the rest succumbing to wounds or chlorine poisoning. The survivors spent the following three years as prisoners of war before returning to Germany.**

American ships – the largest single defeat the US Navy had ever suffered.

But Dönitz and the German political elite underestimated the power and resources of the United States and by May 1943 – known to U-boat men as '*Schwarz Kenn*' or 'Black May' – 41 U-boats had been destroyed. U-boat losses, which previously had been 13% of all boats lost at sea, rose rapidly to 30% and then 50%. A crisis in morale entered the U-boat-Waffe as the realisation dawned that they were now outnumbered by the enemy. Losses were not only suffered in convoy attacks but everywhere else at sea. There was no part of the Atlantic where U-boats were now safe from being spotted by aircraft operating day and night. All U-boat entrance and exit channels in the Bay of Biscay were, in particular, most carefully watched. Losses here were especially high. Dönitz wrote:

Under these circumstances, the previous surface war on convoys could not be continued because, in the meantime, the favourable conditions in the American sphere of activity had also changed and U-boat successes had diminished considerably in that theatre.

The loss of Bay of Biscay ports as operational bases disadvantaged Dönitz's U-boat war. Land communications to the ports were severed by advancing Anglo-American armies removing the chance of sourcing further fuel supplies and torpedoes. Despite favourable opportunities for attacks close to the English coast, there was only a modest increase in sinkings due to the dwindling number of U-boats available, which by now numbered just 13 operational vessels.

Towards the end of 1943, remaining U-boats were forced to spend at least 4 out of every 24 hours on the surface recharging their batteries. The presence of so many Allied aircraft in the skies made it dangerous for any U-boat to spend too much time above water. Thanks to radar, U-boats could now be detected at any hour in daylight, darkness, fog or smokescreen.

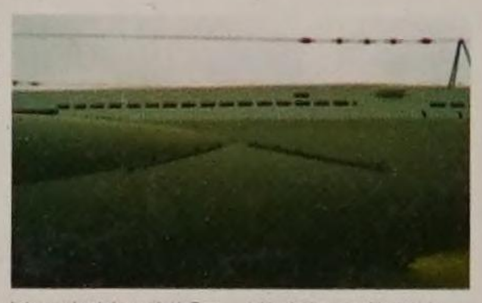
In January 1943 Roosevelt and Churchill had declared that defeating all remaining German U-boats should be given priority. Improved escort vessels armed with radar were

introduced and there were always enough of them to attack whenever a U-boat appeared. But that same month Dönitz took over as chief of the entire Kriegsmarine following Raeder's resignation after a dispute with Hitler. Dönitz became Commander-in-Chief of both the Kriegsmarine as well as C-in-C of U-boats. He paid off most of Germany's big ships and transferred their crews into the submarine service. At last he could mass-produce his U-boats and production was stepped up to 17 new boats monthly – which was still insufficient for Dönitz's needs.

Despite earlier losses, by May 1943 the US Navy was escorting ships carrying over 150,000 American troops across the Atlantic and not a single vessel was lost. At the start, Operation Drumbeat had been one of the Kriegsmarine's greatest victories, but it had failed to knock America out of the war. For Americans the U-boat was never an 'Atlantic Pearl Harbor'. Although U-boats continued to attack American shipping until the last day of the war, when single submarines still ran up to America's doorstep like lone wolves on the prowl, it finally ended in surrender and defeat, and for the U-boat crews, long spells as prisoners of war. The happy times were now over.

By June 1943 the number of Allied ships lost to U-boats in the Atlantic had fallen dramatically. In May that year, 41 U-boats were sunk. In one of them was Leutnant Peter Dönitz, the Grand

ABOVE **On the bridge of Type VII boat U-402 in heavy North Atlantic seas during 1943. Under the command of Korvettenkapitän Siegfried Freiherr von Forstner, Knight's Cross, U-402 sank 15 ships totalling 71,036grt before she herself was sunk in mid-Atlantic by aircraft from USS *Card* on 13 October 1943, all hands being lost.** *(Bundesarchiv)*



RIGHT AND BELOW **All VII class boats had large free-flowing holes in the side deck casing to drain away seawater washed on to the deck.**

for two more large tanks on each side. These provided the necessary buoyancy and ballast and gave the Type VII class its characteristic 'bulged' appearance.

Running along the top of the vessel was a substantial flat wooden **deck casing**, which provided a stable surface for any work needing to be undertaken on top of the vessel. An area between the deck casing and pressure hull provided adequate space for plumbing, wiring and ducting needed to ventilate the boat and receive fuel. It was also used for torpedo storage, air trucks, ammunition stowage and storage of inflatable air rafts. All VII class boats

LEFT **Conning tower with 'bandstand' and 'winter garden'.**

BELOW **The bridge area on top of the conning tower.**

had large free-flowing holes in the side deck casing to drain away seawater washed on to the deck.

The submarine's **conning tower** was another multi-layer structure. Surrounding it was an external tower structure and on top of it a bridge providing a protected site for crew members acting as lookouts once the boat had surfaced.

Of the eight sections of rolled sheet steel making up the pressure hull, only the two centre sections were cylindrical in shape. The remaining sections were truncated cones constructed by welding the rolled sheet steel that comprised the pressure hull skin to a set of circular ribs spaced at 60cm intervals. The only exceptions were the very ends of the hull, which were prefabricated rolled and stamped pieces, two half-conic sections and a spherical section end cap.

Over the entire boat, from bow to stern, was a '**jumping wire**' stretched and attached to the bridge bulwark to allow U-boats to attempt to pass under or through anti-submarine nets and other submerged defences without obstructions snagging the vessel's superstructure. Nets proved to be an effective anti-submarine device. They were strung out across the English Channel, making it almost impossible for U-boats to pass through, and were used to protect harbours in both the United States and Canada. If a submarine became entangled in a net, it had no option but to surface and face

The Type VII U-boat was the workhorse of the German Kriegsmarine in the Second World War. It was also the most numerous German U-boat class of the war with 709 built and the most produced submarine class in history. It enjoyed spectacular victories including the sinking of the liner SS *Athenia* and the aircraft carrier HMS *Courageous* soon after the outbreak of hostilities, which showed how vulnerable unescorted ships were against German U-boats. When U-47 sank the battleship HMS *Royal Oak* in October 1939 inside the Royal Navy anchorage at Scapa Flow it forced the entire Home Fleet to move to temporary anchorages around the Scottish coast.

In the desperate Battle of the Atlantic that raged for much of the war, U-boat wolf packs stalked merchant convoys that were Britain's lifeline, sinking thousands of tons of Allied merchant shipping and taking Britain to the brink of disaster. The U-boat was a game-changer.

Centrepiece of the Haynes *U-boat Manual* is the sole surviving Type VIIC, U-995, which is on public display at the German Naval Memorial in Laboe, near Kiel, in northern Germany. Author Alan Gallop has been given full access to U-995, which has enabled him to give comprehensive insights into the design and workings of the Type VII, from stem to stern and from control room to conning tower. More than 300 photographs and illustrations reveal the Kriegsmarine's scourge of the Atlantic in close-up detail, including rare archive photographs of the Type VII at war.

Author

ALAN GALLOP is an author, journalist and public relations consultant. His books include *Buffalo Bill's British Wild West, Children of the Dark, Mr Stanley I Presume, Time Flies: Heathrow at 60, Subsmash,* and *The Martians are Coming! The True Story of Orson Welles' 1938 Panic Broadcast*. He lives in Middlesex.

ISBN 978 0 85733 404 6 £21.99RRP
02199
9 780857 334046
H4931

Haynes Publishing
Sparkford, Yeovil,
Somerset BA22 7JJ, UK
Tel: **+44 (0) 1963 442030**
Fax: **+44 (0) 1963 440001**
E-mail: sales@haynes.co.uk
Website: www.haynes.co.uk